

Hazard Controls

Control of Nitrous Oxide in Dental Operatories

From the National Institute for Occupational Safety and Health

Description of Hazard

Dental workers are exposed to nitrous oxide (N_2O) during administration of this anesthetic gas to patients. Exposures should be minimized to prevent short-term behavioral and long-term reproductive health effects that can be produced by N_2O .

Description of Controls

National Institute for Occupational Safety and Health (NIOSH) research has shown controls including system maintenance, ventilation, and work practices can effectively reduce N_2O concentrations in dental operations to approximately 25 ppm during analgesia administration, the exposure limit recommended by NIOSH. Uncontrolled

exposures to N_2O have exceeded 1000 ppm. Three methods of control are recommended:

System Maintenance

Inspect and maintain the anesthetic delivery system to prevent N_2O leaks in all hoses, connections, fittings. Repair all leaks immediately. (See Figure 1).

Ventilation

Scavenging System—Use Scavenging. Exhaust ventilation of N_2O from the patient's mask should be maintained at an air flow rate of 45 LPM, measured by a calibrated flow device, and vented outdoors—not into the room ventilation system.

Room Ventilation—Where possible, use 100 percent clean outdoor air for dental operator ventilation. Supply and exhaust vents should be well separated to allow good mixing and prevent “short-circuiting.”

Auxiliary Exhaust Ventilation—Local exhaust hood should be placed near the patient's mouth to capture excess N_2O from breathing.

Work Practices

Select scavenging masks of proper sizes to fit patients. Prudent use of N_2O to appropriately sedate patients is encouraged. Monitor the air concentration of N_2O to insure controls are effective in achieving low levels during dental operations.

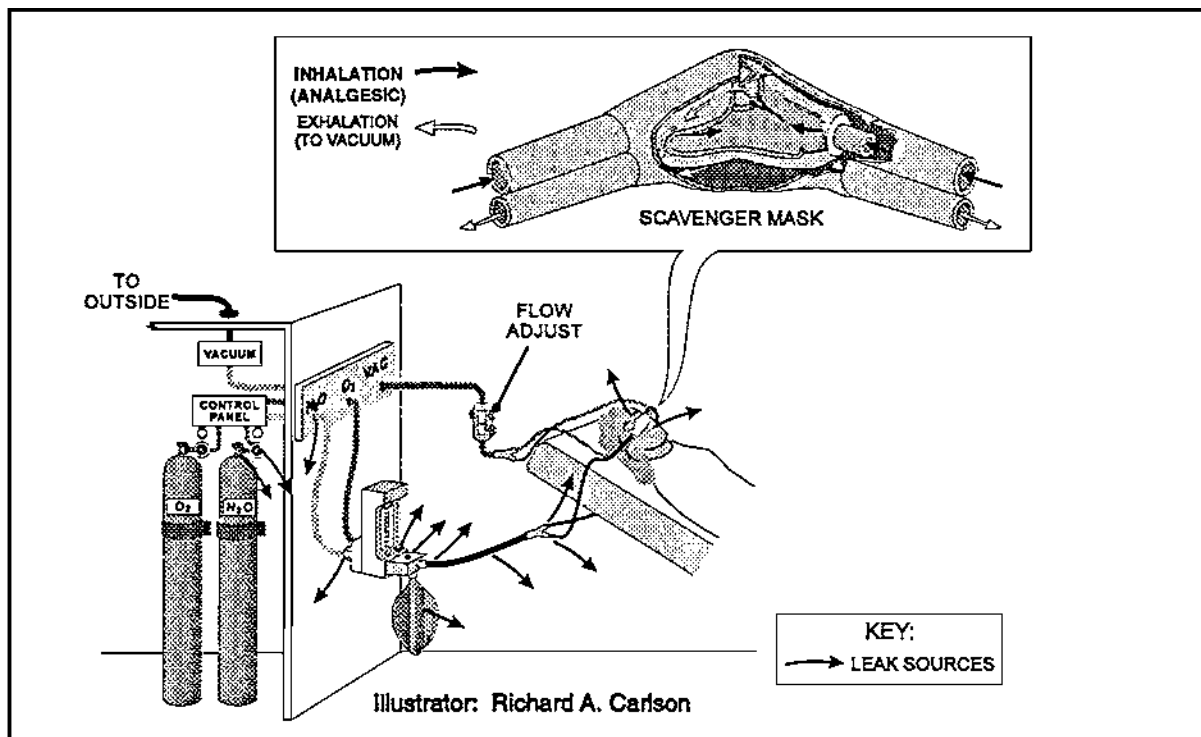


FIGURE 1
Illustration of N_2O anesthetic delivery and scavenging system.

Sampling Methods for N₂O

NIOSH recommends air sampling for N₂O be conducted periodically to: (1) measure worker exposures to N₂O during anesthetic administration—Personal Sampling, and (2) control N₂O leaks in the delivery, scavenging, and ventilation systems—Area Sampling. Sampling can be used to measure personal breathing zone exposures of dental workers, and to detect leaks in the anesthetic delivery system, ineffective capture by the scavenging system, reentry in the room ventilation system, and circulation to other areas of the dental offices. Sampling methods available are summarized below.

Real-Time Sampling

Sampling that provides direct, immediate, and continuous readout of N₂O concentration in air utilizes a portable Infrared Gas Analyzer (IGA) as recommended by the NIOSH Analytical Method 6600. Because this method provides continuous sampling and instantaneous feedback, sources of N₂O leakage and effectiveness of control measures can be immediately determined.

Time-Integrated Sampling

• Bag Sampling

Sample for a selected time period, such as NIOSH recommended method for sampling,

during the time of anesthetic administration to a patient. This is accomplished by collecting an integrated air sample in a plastic bag, impervious to N₂O leakage, using a portable battery-powered pump. Analysis of the bag sample is accomplished using the Infrared Gas Analyzer. The N₂O concentration obtained is an “average value” for the entire sampling period.

• Diffusive Sampler

If real-time or bag sampling-IGA analysis is not available, time-integrated samples using a Diffusive Sampler (sometimes called a Passive Dosimeter) for N₂O can be collected and then sent to a commercial laboratory for analysis. These samplers are easy to use and inexpensive. Sampling time is controlled by removing the cap to start sampling and replacing it to stop sampling. An accurate accounting of the sampling time (cap off/cap on) is required for the laboratory analysis. The Diffusive Sampler can be used to measure a dental worker's exposure by attaching it to the lapel (breathing zone) and uncapping/recapping dur-

ing the actual administration of N₂O.

For More Information

- See Table I for details on controls.
- For free copies of the following reports or for information on other occupational safety and health issues, call NIOSH, at 1-800-35-NIOSH (1-800-356-4674)
 - NIOSH Technical Report: Control of Nitrous Oxide in Dental Operatories
 - NIOSH Alert: Controlling Exposures to Nitrous Oxide During Anesthetic Administration
 - NIOSH Manual of Analytical Methods, Method 6600, Nitrous Oxide, Issue 2, 1994
 - Information about local sources for technical assistance, monitoring equipment for N₂O, flow meters, and auxiliary devices.

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TABLE I
Step by step approach for controlling N₂O

Step	Procedure	Control
1	Visually inspect all N ₂ O equipment (reservoir bag, hoses, mask, connectors) for worn parts, cracks, holes, or tears.	Replace defective equipment and/or parts.
2	Turn on the N ₂ O tank and check all high to low pressure connections for leaks. Use a non-oil-based soap solution to check for bubbles at high pressure connectors, or use a portable infrared gas analyzer.	Determine leak source and fix. If tank valve leaks, replace tank; if worn O-rings, gaskets, valves, hoses, or fittings, replace. Contact the manufacturer for parts replacement. For threaded pipe fittings, use Teflon [®] tape. Do not use this tape on compression fittings.
3	Select scavenging system and mask. Mask should come in various sizes to fit patient. Scavenging systems should operate at air flow rate of 45 lpm.	Provide a range of mask sizes for patients. Check to see that noise levels at the mask are acceptable when the scavenging system exhaust rate is operated at 45 lpm.

(Continued on next page)

TABLE I
Step by step approach for controlling N₂O (*Continued*)

Step	Procedure	Control
4	Connect mask to hose and turn on vacuum pump before turning on N ₂ O. Scavenging system vacuum pump must have capacity to scavenge 45 lpm per dental operation.	Determine proper vacuum pump size for maintaining 45 lpm flow rates, especially when interconnected with other dental scavenging systems. If undersized, replace pump.
5	Place mask on patient and assure a good, comfortable fit. Make sure reservoir bag is not over- or under-inflated while the patient is breathing.	Secure mask with “slip” ring provided. Observe reservoir bag for “good activity” from patient breathing.
6	Check general ventilation for good room air mixing. Exhaust vents should not be close to air supply vents (use smoke tubes to observe air movement in room).	If smoke from smoke tubes indicates room air mixing is poor, then increase the airflow or redesign. If exhaust vents are close to air supply vents, relocate (check with ventilation engineers to make adjustments).
7	Conduct personal sampling of dentist and dental assistant for N ₂ O exposure. Use diffusive sampler or infrared gas analyzer (see sampling methods).	If personal exposures exceed 150 ppm during administration, improve mask fit and make sure it is secure over the patient’s nose. Minimize patient talking while N ₂ O is administered.
8	Repeat procedure in step 7.	If personal exposures are less than 150 ppm but greater than 25 ppm, implement auxiliary exhaust ventilation near the patient’s mouth. Capture distance should be no greater than 10 inches from the patient’s nose and mouth area and exhaust no less than 250 cfm at the hood opening. Avoid getting between the auxiliary exhaust hood and patient’s mouth and nose area.



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