Nitrous Oxide:
Hazards and Proper Use

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What is Nitrous Oxide?

• Nitrous oxide (N2O) is nonflammable, colorless gas with pleasant, sweet odor and taste
• Also called dinitrogen monoxide or more commonly- laughing gas.
• When inhaled, it produces relaxation, and a reduced sensibility to pain.
• **Anesthetic** agent in dental, medical and veterinary operations.
• **Functions** as an analgesic agent for conscious sedation in dental operatories.
• **Many other applications**, such as foaming agent for whipped cream, an oxidant for organic compounds, nitrating agent for alkali metals & a component of rocket fuels.
Routes of Entry & Safe Limits

Inhalation: Most common route of entry

Dermal: Potential for frostbite in liquid form

Exposure Limits:

• OSHA  Not currently regulated
• NIOSH  25 ppm TWA for duration of use
  (for exposure to “waste” gas.)
• ACGIH  50 ppm TWA for an 8-hr use
Metabolism

- Commonly used as a single agent mixed with oxygen for surgical anesthesia
- Absorbed by diffusion through inhalation
- Eliminated through respiration
- Elimination half-life is ~ 5 minutes
- Minimally metabolized through excretion
Health Effects

The following associations have been implicated due to Nitrous Oxide exposure:

- Breathing difficulty and asphyxia, primarily from abuse by inhalation
- Potential for nausea or vomiting
- Potential for Vitamin B12 interference
- Potential for adverse reproductive effects
- Potential frostbite concerns in liquid form
How Exposure May Occur In Dental Clinics

- Inadequate Ventilation or Scavenging systems
- Equipment Malfunction
  - Equipment failure
  - Leaks due to poor connections
- Poor Technique or Use
- Uncooperative Patient

Figure 1. Sources of leaks from anesthesia delivery systems in dental operations.
Surveys performed by consultant to ensure systems are working properly:

- Nitrous oxide levels are < 5ppm
- Air changes are adequate (> 10ACH) in rooms
- All rooms are confirmed to be under negative pressure
Exposure Controls

• Engineering Controls
  • Ensure adequate room ventilation
  • Ensure delivery and scavenging systems are properly maintained
  • Supplemental local exhaust

• Administrative Controls
  • Elimination or Substitution
  • Ensure proper system maintenance.
  • Train staff to recognize hazards & minimize them
  • Ensure Proper Work Practices through effective Policy Design
  • Patient Management

• Personal Protective Equipment (PPE)
  • Use of respirator (must be in RPP Program)
General Room Ventilation

- Dilutes $N_2O$ concentration
- Provides 12 air changes per hour (ACH)
- Removes contaminated air
- Keeps ambient concentrations of $N_2O$ to <25 ppm

Air Supply
Exhaust and Doors

Keep Door Closed

Keep Exhaust Clear

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Occupational Safety Programs
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• To be effective, the scavenging system:
  – Must be used whenever Nitrous Oxide is used
  – Fit patient properly
  – Capture all exhaled N₂O
  – Transport waste gas out of the office-flow rate of 45 lpm.
Bad FIT vs Good Fit

Improper Fit

Proper Fit
Work Practices

• Inspect delivery system prior to N₂O administration.
• Check connections, breathing bags, hoses and clamps.
• Do not fill breathing bag to capacity
  • Over inflation can cause excessive leakage from the mask
  • The bag should collapse and expand as the patient breathes
• Flush the system of N₂O after the procedure by administering O₂ to the patient for five minutes before disconnecting the gas delivery system
OSHA Permissible Exposure Limit (PEL) for N$_2$O is:

a) 500 ppm as an 8-hr Time
b) 50 ppm as an 8-hr Time
c) 25 ppm as an 8-hr Time

d) No PEL

Total: 1
Engineering controls for N2O exposure include all except:
a) Adequate room ventilation.
b) Properly functioning delivery and scavenging systems.
c) Adequate supplemental exhaust.
d) Properly blocking exhaust vents.
Thank You