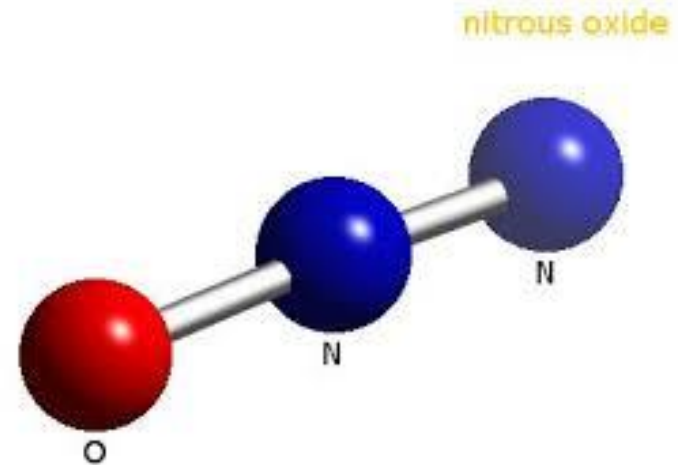


Nitrous Oxide: Hazards and Proper Use

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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.



Uses

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- **A**nesthetic agent in dental, medical and veterinary operations.
- **F**unctions as an analgesic agent for conscious sedation in dental operatories.
- **M**any other applications, such as foaming agent for whipped cream, an oxidant for organic compounds, nitrating agent for alkali metals & a component of rocket fuels.



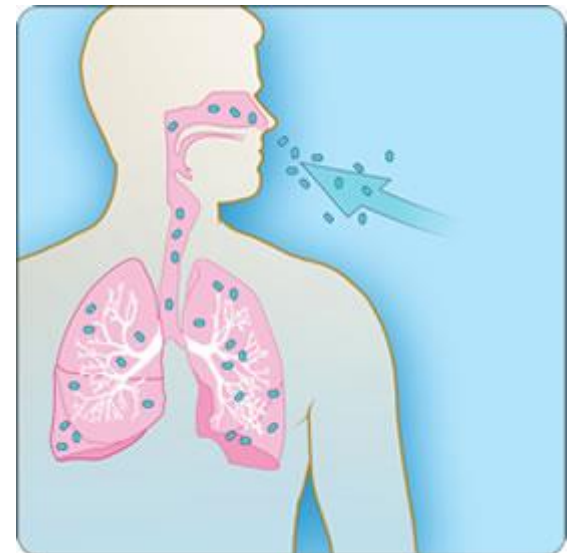
Routes of Entry & Safe Limits

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

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

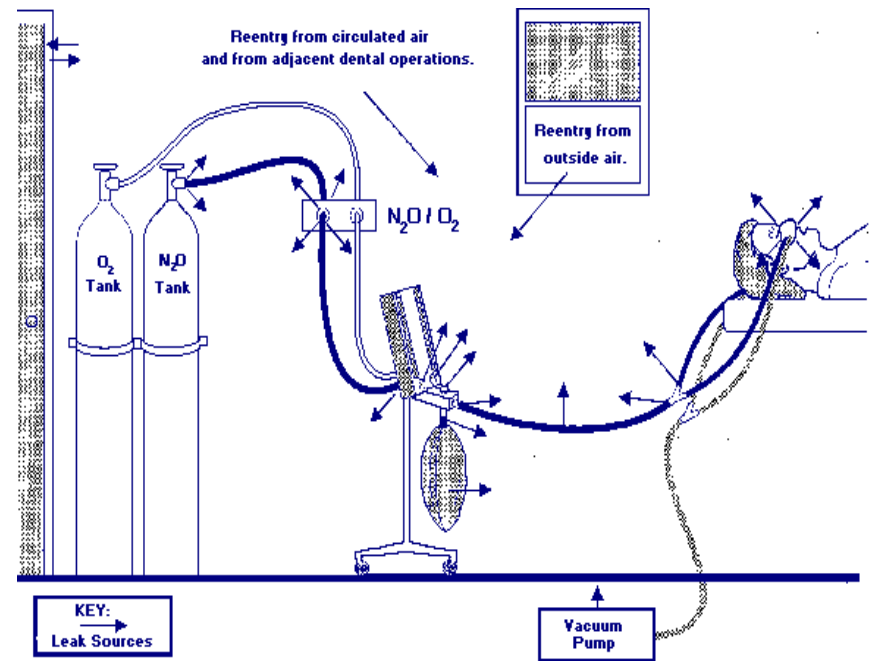


Figure 1. Sources of leaks from anesthetic delivery systems in dental operators.

Exposure Assessment in CUMC Dental Clinics 2014-15

Surveys performed by consultant to ensure systems are working properly:

- Nitrous oxide levels are $< 5\text{ppm}$
- Air changes are adequate ($> 10\text{ACH}$) in rooms
- All rooms are confirmed to be under negative pressure



Exposure Controls

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•Engineering Controls

- Ensure adequate room ventilation
- Ensure delivery and scavenging systems are properly maintained
- Supplemental local exhaust

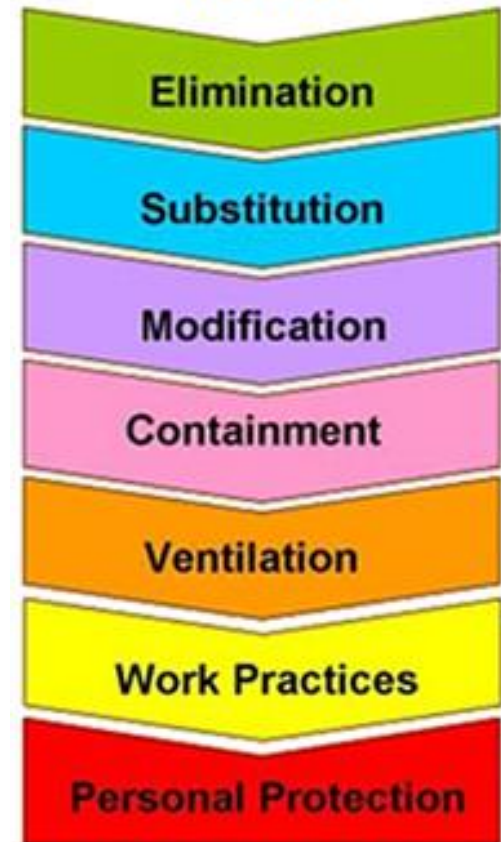
•Administrative Controls

- 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)

Traditional Hierarchy
of Exposure Control
Practices



Engineering Controls: Ventilation System

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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

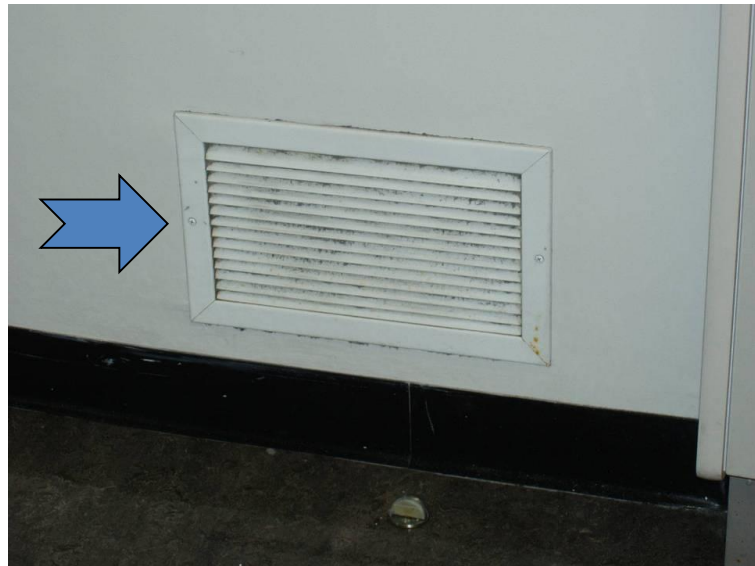


Exhaust and Doors

Keep Door Closed



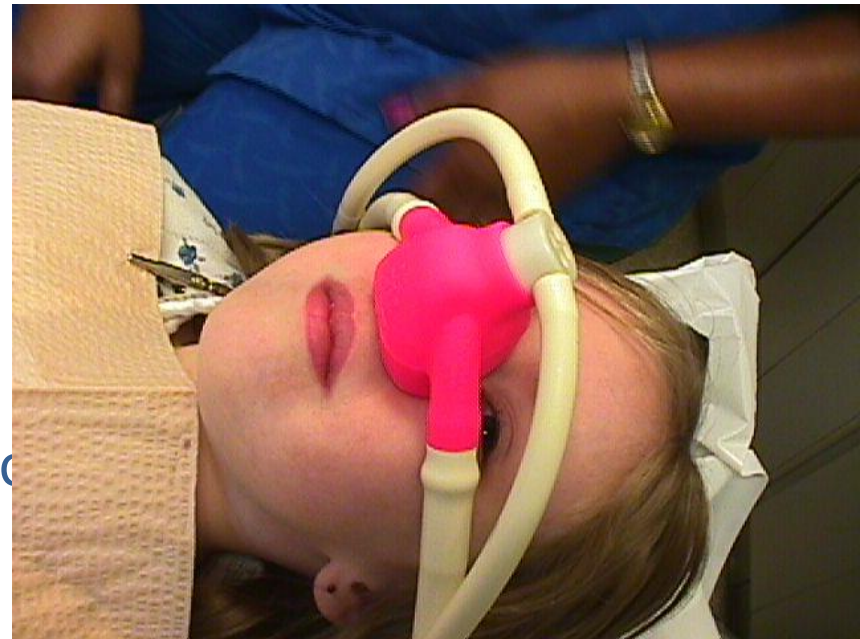
Keep Exhaust Clear



Engineering Controls: Scavenging Systems

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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

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- 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 N₂O 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

Quiz

OSHA Permissible
Exposure Limit (PEL)
for N₂O is:

d) No PEL

Quiz

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.

Quiz

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Engineering controls for N₂O exposure include all **except:**

d) Properly blocking exhaust vents.

Thank You