A Campaign to Prevent Inhalant Abuse
Bureau of Substance Abuse Services
Massachusetts Department of Public Health

AUDIENCE: Adults Only

The Massachusetts Department of Public Health
Bureau of Substance Abuse Services

B U L L E T I N

Nitrous Oxide Alert

Introduction: Nitrous oxide (N_2O), also known as "laughing gas," is a colorless, odorless, weak anesthetic gas that is being abused for its drug-like effects by teenagers and adults. Many people are unaware of the dangers of active inhalation (as a form of *inhalant abuse*) or chronic low level exposure (in medical, dental, and veterinary settings). The Massachusetts Department of Public Health is issuing this bulletin to alert youth-serving professionals and the public about the dangers of chronic exposure and especially non-medically supervised use of this gas.

The Massachusetts Department of Public Health is seeking to reduce the accessibility of N_2O by enlisting the cooperation of law enforcement, retailers, and wholesale distributors in curtailing the illegal use of nitrous oxide. Retailers are asked to monitor the sale of whipped cream chargers and canned whipped cream. Wholesale distributors are asked to restrict sales and sell only to clearly identified legitimate users. People responsible for the sale of nitrous filled balloons at concerts and sporting events, a clear violation of Massachusetts Law, should be prosecuted.

Why is nitrous oxide dangerous? N_2O is a central nervous system depressant that is absorbed through the lungs and is rapidly distributed throughout the body. It can cause health problems, accidents, and death. Frostbite damage to the throat and vocal cords results when the gas is inhaled directly from high pressure tanks; it becomes very cold when it changes from a liquid in the tank to a gas as it leaves the tank. Accidents result when impaired users have toppled heavy tanks onto themselves. Long term exposure, even at very low levels, may result in infertility or a vitamin B_{12} deficiency (which causes anemia and nerve degeneration, producing painful sensations in the arms and legs, an unsteady gait, loss of balance, irritability, and intellectual deterioration).[1]

How does nitrous oxide cause death? Most deaths are caused by suffocation. Breathing the pure gas without sufficient oxygen will produce asphyxiation. This occurs when the gas is used without auxiliary oxygen or in a small enclosure such as when a plastic bag is used as a hood, or in a bathroom, closet, or car. Also, a user may be breathing the gas from a plastic bag, lose consciousness, and choke on the bag as it is sucked into the mouth. Another danger is choking on vomit while unconscious. Exposure to concentrations of N_2O in excess of 10% combined with oxygen deficiency will compromise a person's ability to think and act safely and has been a factor in deaths related to accidents and car crashes.

What are the patterns of N_2O abuse? Most abusers are using the gas occasionally. Nitrous is being used at parties, in dormitories, fraternities, and at concerts and sporting events. There are a number of reports of abuse by dentists,[2] though this has decreased as more dental personnel have become aware of the dangers.[3] Restaurant workers may obtain N_2O from whipped cream dispensers. At least one study has shown that nitrous oxide may be addictive.[4]

What are the workplace dangers? While medically approved for patients when used as an anesthetic, health concerns have been raised for medical, dental, and veterinary personnel exposed to long term, low levels of nitrous oxide in the workplace. The National Institute for Occupational Safety and Health (NIOSH) has concluded that, "exposure to N_2O causes decreased mental performance, audiovisual ability, and manual dexterity. Data from animal studies demonstrate that exposure to N_2O may cause adverse reproductive effects such as reduced fertility, spontaneous abortion, and neurological, renal, and liver disease." In medical settings where N_2O is utilized, NIOSH recommends scavenger systems to remove exhaled N_2O from the air and maintain an ambient level of less than 25 parts per million.[5]

What are the legal issues? In Massachusetts, inhalant abuse is illegal [Massachusetts General Law, Chapter 270-18. See www.state.ma.us/dph/inhalant]. However, the law has been difficult to enforce because it requires a sworn officer to witness the sale, purchase or use of an inhalant. Recently, there has been a successful prosecution in the death of a Virginia student based on the Federal Food, Drug, and Cosmetic Act. The owner of a web site was convicted for selling the nitrous oxide in "whippets" as a drug.[6] "Whippets" are whipped cream chargers–small metal cartridges about 2½ inches long.

What are the effects of nitrous oxide on the human body? The painkilling and numbing qualities of nitrous oxide begin to take effect when the gas is at concentrations of 10 percent. At higher concentrations, approaching 50%, a sense of well-being or euphoria is experienced. A person experiencing the effects of nitrous oxide may:

- Have slurred speech
- Have difficulty in maintaining his or her balance or walking
- Be slow to respond to questions
- Be immune to any stimulus such as pain, loud noise, and speech
- Lapse into unconsciousness (at higher concentrations)

If a person remains conscious and stops breathing the nitrous oxide, recovery can occur within minutes. A person who is rendered unconscious by nitrous oxide is likely to stop breathing within a few seconds as a result of a depressed central nervous system--brain, brain stem, and spinal cord. This depression is caused by a combination of the effects of nitrous oxide and the lowered oxygen content that occurs as pure N_2O displaces oxygen from the lungs with each succeeding inhalation of the gas. The end result is that the person can be asphyxiated.

Death usually occurs when abusers, in their attempt to achieve a higher state of euphoria, breathe pure N_2O in a confined space -- in a small room or an automobile, or by placing their head inside a plastic bag. Tragedy can occur very quickly. Prolonged exposure to high concentrations of N_2O without supplemental oxygen, or a series of inhalations (without breathing clean air between inhalations) can result in death. This can happen in seconds. Since the narcotic effect of a single breath of nitrous oxide is very brief (lasting for only seconds), abusers tend to repeatedly inhale in order to stay "high," increasing the danger. With N_2O, there is no sensation of choking or gasping for air to warn the abuser that asphyxiation is imminent. A person who loses consciousness, and continues to inhale the pure gas, will die.[7]

How does nitrous oxide get into the hands of abusers? Nitrous Oxide is readily available and can be obtained from many different commercial, medical, and retail sources. It is found in homes, schools, restaurants, and medical and industrial settings where it is often easily accessible and not closely regulated. Used to foam dairy cream, it is found in canned whipped cream and whipped cream chargers ("whippets"). A small device called a "cracker" is used to break the seal on the cartridge and release the gas so it may be stored in a heavy duty balloon. The cartridges are easily available at restaurant supply stores, kitchen stores, "head shops," hardware stores, and over the internet. Whipped cream cans may be purchased or stolen from grocery and convenience stores or found in the home, cooking programs or restaurants.

Large tanks of nitrous oxide are stolen from hospitals, delivery trucks, and dental offices or purchased from commercial gas suppliers under the pretext of legitimate use. Balloons filled from the tanks are illegally sold at concerts and sporting events or distributed at parties and in college dormitories. Nitrous oxide cylinders range in size from roughly two feet in height to more than five feet and are color-coded light blue. Contents range from about six pounds to more than sixty pounds of liquid in a large cylinder. Depending on cylinder size and product purity, legitimate users pay between $40 and $75 per cylinder. The highest purity level, used in semiconductor processing, costs considerably more.

Welding supply companies and auto supply stores are another source of nitrous oxide tanks. These tanks are black and the gas is denatured by adding sulphur dioxide. This product may be transfilled into smaller cylinders and sold without being labeled as denatured.[7]

What do you do if you suspect a young person is using nitrous oxide use? Experts recommend several steps during a crisis:

- See that he or she is quickly removed from the source of N_2O and gets fresh air.
- If not breathing, administer artificial respiration.
- Call an ambulance.
- Stay with the person until he or she receives medical attention.
- For more information, call the Massachusetts Poison Control Center at 1-800-222-1222 [TTY: 1-888-244-5313].

Assessment Issues: 1) Because inhalants are seen by many substance abusers as "low status" or "childish," adults and teenagers may be especially reluctant or embarrassed to admit use. 2) Many youth confuse "inhaling" with "smoking" or "snorting." For example, you might ask, "Have you ever inhaled anything to get high, such as the gases or fumes or vapors from household products or products used in a shop or a garage or in an art project. I am **not** talking about anything you might *smoke,* like tobacco, marijuana, or crack or anything you might *snort* like cocaine." 3) Because people may not be aware of the special dangers of inhalants, anyone who has experimented with them even once should receive inhalant abuse prevention education. Parent education and involvement is also essential.

Treatment Considerations: Nitrous oxide abuse as well as other types of inhalant abuse will often be part of a larger picture of substance abuse which may require treatment. In addition, inhalant abusers have very high relapse rates. Aftercare and follow-up are extremely important.

Treatment Options: Through its network of community providers, the Massachusetts Department of Public Health supports outpatient and residential programs for people who are abusing inhalants and other substances. For information on programs, call the Massachusetts Substance Abuse Information and Education Helpline (617-445-1500 in the Boston metropolitan area or 1-800-327-5050 statewide).

What can be done to prevent inhalant abuse? Telling youth the names and types of products that can be abused increases the likelihood that some youth will experiment with inhalants. A key prevention message is that products should be used for their intended purpose and in a safe manner. Inhalants should be equated with poisons, pollutants, and toxins, and **not** drugs. Children should not be taught what products can be abused or that they can be used "to get high"; rather the damaging effects of inhalants should be stressed. Other strategies include teaching refusal skills; supporting positive youth development and leadership; and educating parents and other community members. To learn more about comprehensive, science-based prevention, contact your local Massachusetts Prevention Center (to find the location, call the Massachusetts Substance Abuse Information and Education Helpline (617-445-1500 in the Boston metropolitan area or 1-800-327-5050 statewide). Additional information and materials can be obtained from the Massachusetts Inhalant Abuse Task Force at CASPAR Youth Services (617-623-2080), or visit our web site www.state.ma.us/dph/inhalant.

1. "Nitrous Oxide Fact Sheet." Compressed Gas Association [www.cganet.com] Arlington, VA [703-412-0900] See also, "Occupational Safety and Health Guideline for Nitrous Oxide." Occupational Safety and Health Administration [www.oshaslc.gov/SLTC/healthguidelines/nitrousoxide]

2. Paulson, G. W. "Recreational Misuse of Nitrous Oxide." Journal of the American Dental Association. 1979 March 98(3): 410-1.

3. NIOSH [1996] "Control of Nitrous Oxide in Dental Operatories." US Public Health Service, Centers for Disease Control, National Institute for Occupational Safety Publication No. 96-107. [www.cdc.gov/niosh/nitoxide.html]

4. Gilman, M. "Review: Nitrous Oxide in Perspective." Clinical Neuropharmacology (1992) 15:pp297-306.

5. NIOSH [1994]. "NIOSH Alert: Request for Assistance in Controlling Exposure to Nitrous Oxide During Anesthetic Administration." US Public Health Service, Centers for Disease Control, National Institute for Occupational Safety Publication No. 94-100, April 1994. [www.cdc.gov/niosh/noxidalr.html]

6. Meadows, Michelle. "Investigators' Reports: Arizona Man Sentenced for Selling Nitrous Oxide." FDA Consumer Magazine (May-June 2001) Federal Drug Administration. [http://www.fda.gov/fdac/depart/2001/301_irs.html]

7. Compressed Gas Association [www.cganet.com] Arlington, VA [703-412-0900]