Introduction

Purpose
This chapter provides guidelines for minimizing exposure to nitrous oxide and compliance with applicable nitrous oxide regulations.

Applicability
This chapter is applicable to all Temple University employees, to all work conducted under the authority of Temple University, and to all equipment and property managed by Temple University. Non-Temple and contractor personnel will follow the provisions of this chapter while at Temple University facilities.

Regulations
Currently there are no OSHA regulations concerning the use of Nitrous Oxide. The National Institutes for Occupational Health and Safety (NIOSH) has established a recommended exposure limit of 25-ppm (parts per million) for the period of exposure.

Health Effects
NIOSH recognizes that Nitrous Oxide can freeze tissue. When present in high enough concentrations in the atmosphere, suffocation may result as it replaces oxygen. It may also cause drowsiness, euphoria or unconsciousness. There is also evidence that it may cause adverse effects in unborn babies.

Responsibility

Environmental Health and Radiation Safety Department
The EHRS department has the following responsibilities related to Nitrous Oxide activities:
1. Policy development.
2. Surveillance as requested by responsible supervisor.
3. Training as requested by responsible supervisor.
4. Exposure monitoring.

Supervisors and Managers
Supervisors and Managers have the following responsibilities related to Nitrous Oxide activities:
1. Assessment of their site and operations to determine whether Nitrous Oxide is present or used.
2. A copy of this procedure should be made available to all users. Additional copies are available through the EHRS department.
3. Review and approve proposed uses of Nitrous Oxide containing products in areas within their jurisdiction. Such approval signifies that management will provide the resources necessary to control hazards and will establish, as organization policy, the procedures necessary to comply with OSHA, EPA, and other government regulations. Such compliance may include the following actions:
   • Provide employee training regarding the safe use, storage, and disposal of Nitrous Oxide.
   • Ensure the availability and proper function of safety equipment, i.e., nitrous oxide alarms, ventilation equipment, vacuum scavenging equipment (as appropriate), respirators and gloves.
   • Assure that anesthesia equipment related to the use of Nitrous Oxide is evaluated on a quarterly basis.
• Maintain records of equipment evaluation.
• Maintain an adequate stock of required personal protective equipment (PPE).
• Provide equipment such as eyewash stations, showers, and ventilation devices when required.
• Make requests to the EHRS department for required exposure monitoring and surveillance of work activities.
• Maintain relevant Material Safety Data Sheets (MSDSs) for Nitrous Oxide products used.
• Make regular visual inspections for leaks for facilities with Nitrous Oxide.

4. Do not expose pregnant women to Nitrous Oxide, as it may cause adverse reproductive effects.
5. Control waste Nitrous Oxide with a scavenging system that includes securely fitting masks, sufficient flow rates for the exhaust system, and properly vented vacuum pumps.

Nitrous Oxide Users
Nitrous Oxide users are those workers who work with or handle Nitrous Oxide-containing products in their job. These workers have the following responsibilities related to Nitrous Oxide activities:
1. Attend required training classes.
2. Properly use and maintain PPE.
3. Comply with Temple University and government regulations as they pertain to Nitrous Oxide use.
4. Inspect all anesthetic delivery systems and connections before starting anesthetic gas administration.
5. Eliminate or replace loose-fitting connections, loosely assembled or deformed slip joints and threaded connections, and defective or worn seals, gaskets, breathing bags and hoses.

Facilities Engineers
The Facilities Engineering Supervisor for an area where Nitrous Oxide is used shall;
1. Ensure that his staff is trained in the safe handling of Nitrous Oxide.
2. Ensure the availability of safety equipment for his employees.
3. Notify the EHRS department whenever a change to the ventilation system may effect the exhausting of the Nitrous Oxide from the work area(s).

Exposure Monitoring

There are no regulatory requirements for Nitrous Oxide exposure levels or monitoring frequency, however Temple University had adopted the Recommended Exposure Limit of 25-ppm. Monitoring is performed when requested and to develop a base-line database of worker exposures. The Temple University defined action level (AL) for Nitrous Oxide is 12.5-ppm, as an eight-hour time weighted average.

Controlling Nitrous Oxide Exposure

Engineering Controls - Ventilation Systems
It is the policy of the Temple University that all Nitrous Oxide-related work activities with potential for exceeding the Action Level shall implement feasible engineering controls. Examples of engineering controls include ventilation systems, air pollution control devices, laboratory hoods, enclosures, shields, barriers, isolation chambers, automatic emergency shut off valves, and remote-control equipment.
The following considerations should be included in the design and installation process for such equipment:
1. To minimize Nitrous Oxide exposure and control the buildup of gases and vapors in the general work area, it is important that adequate room ventilation be provided. The recommended ventilation rate for laboratory areas is 4 to 12 air changes per hour. To prevent gas and vapor migration into adjacent areas, the Nitrous Oxide work area should be maintained at a negative air pressure with respect to surrounding rooms. In addition, it is essential that air in the Nitrous Oxide work area be 100-percent exhausted to the outdoors. The exhaust duct stack must be located a sufficient distance from any building air intakes to prevent re-introduction of contaminated air.
2. If the facility ventilates containers of contaminated clothing and equipment, the facility shall establish an appropriately labeled storage area for this purpose, and locate and arrange it in a manner that minimizes Nitrous Oxide exposure. The facility shall allow only persons trained in recognizing the hazards of Nitrous Oxide to remove containers from the storage area.

Work Practices

Each facility shall examine the work practices that employees use, and consider alternative work practices that will minimize exposure.

Container Labels

Containers of Nitrous Oxide must have labels indicating that they contain Nitrous Oxide. The label must list the name and address of the responsible person; and must state that physical and health hazard information is readily available from the employer and from MSDSs.

Leak Detection

Facilities with Nitrous Oxide shall create and maintain a program to detect leaks. The equipment leak detection program shall include:
1. Regular visual inspections for leaks;
2. Preventative maintenance of equipment, including surveys for leaks, at regular intervals;
3. Prompt repair of leaks by persons wearing appropriate protective clothing and equipment and who are trained in the proper methods.

Emergency Situations

1. Immediately evacuate all persons in the area!
2. Close all the doors.
3. Notify in the following order:
   - Campus Police (1-1234) or Page Operator (2-4545).
   - EHRS (215-707-2520) or Page Operator (215 707-4545). Response is available 24-hrs/day, 7-days/week.
4. Do not re-enter until the EHRS representative has monitored the atmosphere and cleared the room(s) for re-entry.
Medical Surveillance Program

The medical surveillance program is provided to monitor the health of Nitrous Oxide-exposed employees, and determine whether continued exposure will adversely affect their health.
1. The medical surveillance program is mandatory for the following groups of employees: Employees who are exposed at or above the Action Level.
2. The medical surveillance program is optional for the following groups of employees: Employees who show symptoms of Nitrous Oxide exposure and employees who are exposed during an emergency.

Hazard Communication Program

The hazard communication program must address the following items:
1. Material Safety Data Sheets (MSDSs)
2. Container labeling of Nitrous Oxide
3. Instructions to immediately report signs of Nitrous Oxide exposure to the supervisor.
4. Uses and limitations of PPE.
5. Instructions for handling leaks and emergency situations.
6. Proper work practices and the use of engineering controls.

Employee Training Requirements

Nitrous Oxide training is part of the workplace Hazard Communications Training that shall be provided to all employees. Information regarding this training can be obtained from the EHRS department. This training must be provided at the time of the initial job assignment and whenever there is a change to the work process. At a minimum, the topics addressed in the hazard communication training shall include:
1. The contents of the OSHA Hazard Communication Standard (29 CFR 1910.1200), as well as the location and availability of these regulations.
2. The contents of MSDSs.
3. Health risks of workplace hazards
4. The medical surveillance program.
5. PPE use and limitations.
6. Instructions for the use of engineering controls in minimizing exposure.
7. Instructions for handling leaks and emergency situations.
8. Access and location of training materials for the affected employees.
9. Container labeling requirements.

Record-keeping Requirements

The EHRS department will keep accurate and complete records for all Nitrous Oxide-related work areas. The records shall consist of:
1. Exposure Monitoring Records, which will include;
   • The date the measurement was taken.
• The operation that is being monitored.
• The sampling and analytical methods used and evidence of their precision and accuracy.
• The number, duration, time of day, and results of samples obtained.
• The types of protective devices worn.
• The names, job classifications, social security numbers, and exposure estimate of employees whose exposure is represented by actual monitoring results.
• When it is felt that objective data will relieve exposure-monitoring requirements, records shall consist of the objective data and calculations that demonstrate that no employee is exposed to cyanide at or above the Action Level.
• Exposure monitoring records shall be kept for the duration of the employee's employment plus at least 30 years.

2. Medical Evaluation Records, shall consist of:
• The name and social security number of the employee.
• The physician's written opinion.
• A list of employee health complaints that may be related to exposure to cyanide.
• A copy of the employee's medical examination results, medical questionnaires, and results of medical tests that are required by the regulation or mandated by the examining physician.
• Medical evaluation records shall be kept for the duration of the employee's employment plus at least 30 years.

3. Respirator Fit Test Records shall consist of:
• A copy of protocol used to test the fit of negative-pressure respirators.
• The name and social security number of each employee assigned to wear a negative-pressure respirator.
• The date of the employee's most recent respirator fit test and a copy of the test results.
• A list of the brands, types, and sizes of respirators available at the facility from which respirator selection and assignment was made.
• Respirator fit test records shall be kept until replaced by a more recent record.
• Contractors are responsible for complying with these record-keeping requirements for their own employees.