Respiratory Protection Program

Program Statement

Northwestern University commits to evaluate all work assignments where regulated respiratory hazards are known or suspected to be present. Northwestern University maintains a respiratory protection program in accordance with Occupational Safety and Health Administration (OSHA) regulation and a hierarchy of controls in which respirator use is considered as a last resort.

Reason for Program/Purpose

Respiratory hazards can be encountered when operating and maintaining an educational institution and in science teaching and research. Inhalation of harmful dusts, fibers, biological hazards, fumes, mists, gases, smokes, sprays, or vapors can cause occupational diseases. The priority is to minimize routes of respiratory exposure through engineering control measures (e.g., enclosure or confinement of the operation, exhaust ventilation) or administrative control measures (e.g., substitution of less toxic materials). When effective engineering and/or administrative controls are not feasible or while they are being instituted, appropriate respirators shall be provided and used pursuant with this program. This program outlines the information, services, and training available at Northwestern University on the safe use and handling of respirators.

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Who Approved This Program

Laboratory and Chemical Safety
Committee Jay Walsh, VP of Research
Michael Blayney, Office for Research Safety
Chris Johnson, Risk Management
Ronald Naylor, Facilities Management

Who Needs to Know This Program

This program applies to all Northwestern University students and employees, and contract personnel whose work assignments in potentially hazardous atmospheres are directly supervised by Northwestern employees. These persons are referred to as respirator users. Respirator users are required to wear respirators during normal work assignments, and during some non-routine or emergency assignments.

Website Address for this Program

http://www.research.northwestern.edu/ors/forms/respiratory-protection.pdf

Contacts

If you have any questions on the program or procedure for Respiratory Protection Program, you may:

1. Call the Office for Research Safety at (847)-491-5581, or
2. Send an e-mail to researchsafety@northwestern.edu

Definitions

Air Purifying Respirator (APR) A respirator with an air-purifying filter, cartridge or canister that reduces or removes specific air contaminants.
Air purifying respirators are negative pressure, positive pressure or loose fitting (i.e. Powered Air Purifying Respirator (PAPR)). Only respirators certified by the National Institute of Occupational Safety and Health (NIOSH) are selected. Maximum use concentration and assigned protection factors are determined in the hazard assessment. APF=10-50

**Assigned protection factor (APF)**
Is the minimum anticipated protection provided by a properly functioning respirator. The APF is assigned by NIOSH.

**Canister or cartridge**
A container with a filter, sorbent, or catalyst, or a combination of these items, that removes specific contaminants from the air passed through the container.

**Dust mask**
A filtering face piece or a face mask that may be voluntary worn in environments where a respirator is not required.

**Hazard assessment**
A formal review process of inhalation hazards initiated by the supervisor. ORS staff will assess path of exposure, control methods, affected employees, respirator selection, respirator cartridge selection and limitations.

**High Efficiency Particulate Air (HEPA) filter**
A filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR84 particulate filters are the N-100 and P100 filters.

**Immediately Dangerous to Life or Health (IDLH)**
An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual’s ability to escape from a dangerous atmosphere. In IDLH environments - for example in an oxygen deficient atmosphere – only use of a SCBA is permitted.

**N-95 respirator**
A NIOSH certified respirator type where the face piece is made of the filtering material. It is used as a negative pressure respirator most often to prevent respiratory exposure to biological hazards. APF=10

**Oxygen deficient atmosphere**
An atmosphere with oxygen content below 19.5% by volume is an IDLH environment. Only use of a SCBA is permitted.
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td>Powered Air Purifying Respirator (PAPR)</td>
<td>A device equipped with a face piece, hood or helmet, breathing tube, canister, cartridge, filter, and a powered blower. Users of loose fitting PAPRs are not required to be medically cleared and fit tested. APF=25</td>
</tr>
<tr>
<td>Respirator User</td>
<td>An individual who has been trained in the Respiratory Protection Program. Users of respirators with tight fitting face pieces such as APRs and SCBAs are medically cleared and fit tested.</td>
</tr>
<tr>
<td>Self Contained Breathing Apparatus (SCBA)</td>
<td>An atmosphere supplying respirator with a tight fitting full face piece, where the breathing air source is carried by the user. Only respirators certified by the National Institute of Occupational Safety and Health (NIOSH) are selected. APF=10,000</td>
</tr>
<tr>
<td>Tight fitting face piece</td>
<td>Part of NIOSH N- or P-type filtering masks, negative pressure air purifying respirators, and face pieces for SCBA. Users of tight fitting respirators must be medically cleared, trained and fit tested annually.</td>
</tr>
</tbody>
</table>

**Program/Procedures**

The Office for Research Safety (ORS) is assigned to validate all mandated respiratory protection needs and assure that the affected employee has met the criteria set forth by OSHA. The Respiratory Protection program is administered by ORS.

**Responsibilities of the Program Administrator**

- Develop and evaluate the written Respiratory Protection Program.
- Coordinate with NU Purchasing to provide guidance to responsible supervisors for selection and purchase of approved respirators and respirator filters, cartridges or canisters
- Develop and provide Northwestern University Respiratory Protection training
- Provide qualitative and quantitative fit testing.
- Coordinate with occupational health providers, supervisors and employees to facilitate medical evaluations for respirator use.

**Responsibilities of the Department**
Departments whose employees may be exposed to respiratory hazards are responsible for providing the necessary and appropriate resources to ensure proper respiratory protection is implemented.

Responsibilities of Supervisors

Note: The responsibilities outlined below apply to Northwestern University employees who supervise other NU employees or contract workers.

- Identify and report the following to the Program Administrator:
  - Hazardous materials or infectious agents used without other exposure control measures
  - Employees who may be exposed to respiratory hazards
  - Tasks or jobs conducted requiring respiratory protection
- Develop a written Standard Operating Procedure for respirator area and affected employees
- Coordinate periodic medical surveillance, training and respirator fit testing of affected employees
- Obtain appropriate respirators and accessories for each affected employee
- Supervise the schedule of respirator filter change outs
- Conduct ongoing work-site assessments to ensure effective plan implementation

Responsibilities of Respirator Users

- Before wearing respirators with tight fitting face pieces, provide the medical clearance record to the ORS Program Administrator.
- Get the face piece fit tested regularly.
- Use respirators according to instruction and training provided by supervisor and ORS.
- Clean, store and maintain respirator properly.
- Inspect respirator before each use.
- Report to supervisor any malfunction of respirator or difficulty with respirator use.

Occupational Health Provider

The Program Administrator selects physicians or licensed healthcare professionals (PLHCP) for the Program. The selected PLHCP conducts medical evaluations and examinations, provides written recommendations and maintains medical records according to the OSHA Standard. The Occupational Health Provider retains records of medical evaluations for the duration of employment and 30 years thereafter.

Chicago Campus:
• **Corporate Health program at Northwestern Memorial Physicians Group**,  
  676 N. Saint Clair Street, Suite 900  
  Chicago, IL,  
  Phone (312) 926-5862 or (312) 926-4457

Employees must provide a chart string.

**Evanston Campus:**

• **Students**: University Health Service. Be prepared to provide a chart string.

• **NorthShore University HealthSystem OMEGA**  
  1000 Central St., Suite 800  
  Evanston, IL  
  Phone (847) 657-1700

Employees must provide billing authorization.

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**Program Evaluation**
ORS shall conduct evaluations to ensure this program is being properly implemented. ORS shall regularly consult laboratory workers required to use respirators to assess the laboratory workers' views on program effectiveness and to identify any problems. This review is done during laboratory safety inspections and annually required respirator fit testing. Factors to be assessed include, but are not limited to:

- respirator fit (including the ability to use the respirator without interfering with effective workplace performance),
- appropriate respirator selection for the hazards to which the laboratory worker is exposed,
- proper respirator use under the workplace conditions the laboratory worker encounters,
- proper respirator maintenance, and
- recordkeeping

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**Forms/Instructions**

**Voluntary Use of Dust Masks**
The voluntary use of dust masks is only permitted in an environment where airborne hazards are low. Voluntary use of dust masks does not require special user training, medical evaluation or face piece fit testing.

**Voluntary Use of Respirators**
Voluntary users of tight fitting respirators in an environment where no respirators are required shall complete the ORS Respiratory Protection training and be medically cleared to wear a tight
Use of Loose Fitting Respirators

Users of loose fitting PAPRs are required to complete ORS Respiratory Protection training but are not required to be medically cleared and fit tested.

Use of Tight-fitting Respirators

Users of tight fitting respirators are required to complete the ORS Respiratory Protection training and obtain medical clearance to wear a respirator. Respirator users shall receive interactive training in respirator use, limitations, and care. The respirator user shall clean and disinfect non-disposable respirators on a regular basis and inspect before and after each use.

Respirator users are respirator fit tested annually. Fit testing is necessary to establish that the chosen respirator seals to the face properly to prevent inward leakage of contaminants. Respirators shall not be worn when conditions prevent a good facepiece-to-face seal, as with beard growth, sideburns, earrings, head scarves, wigs, facial piercings or dentures. With full-face respirators, temple bars on eyeglasses interfere with the sealing edge of the facepiece.

Tight-fitting Respirator Seal Check.

Respirator users must perform a seal check to demonstrate that an adequate seal is achieved each time the respirator is put on.

For tight-fitting respirators with a filtering face piece (i.e. N-95), cover the respirator with the hands and exhale into the filtering facepiece. Check around the outer fringes of the facepiece for leakage. Inhale gently so that the facepiece collapses slightly. You should not detect any leakage around the nose, chin or anywhere else along the face seal. For other tight fitting respirators follow the seal check instructions below.

1. Positive Pressure Check
   a. Close off the exhalation valve by lightly placing a palm over the exhalation cover. For many respirators, this method of leak testing requires the wearer to first remove the exhalation valve cover before blocking off the exhalation valve. The cover is then replaced after the test.
   b. Gently exhale into the respirator and create a slight positive pressure.
   c. Once you feel pressure in the facepiece, use your free hand to check around the outer fringes of the facepiece for leakage.
   d. Do you detect an opening? If so, the respirator must be readjusted to seal more firmly to your face. The positive pressure check is repeated until the build-up of a slight positive pressure inside the respirator is not accompanied by outward leakage.

2. Negative Pressure Check
a. Close off the inlet opening for the filter, cartridge or canister. This is done by covering the opening with the palms of your hands or by replacing the filter seals. The design of the inlet opening of some cartridges cannot be covered effectively with the palm of the hand. The test can also be performed by covering the inlet opening with a thin latex or nitrile glove or a piece of paper.

b. Inhale gently so that the facepiece collapses slightly and hold your breath for approximately 10 seconds.

c. As the facepiece remains slightly collapsed toward your face, pay attention to any potential leaks. You should not detect any inward leakage of air into the respirator if the seal is satisfactory.

d. Do you detect a leak? If so, the respirator and/or the harness straps must be readjusted to seal the facepiece more firmly to your face. The negative pressure check is repeated until no leakage is perceived.

3. **Hazard Assessment**

Generally proper engineering controls are designed to make respiratory protection unnecessary. Examples are laboratory work at a certified vented fume hood or certified biosafety cabinet, or other device with verified containment performance. There are many variables that affect the degree of protection afforded by respiratory protective devices, and the misuse of respirators can be hazardous to employee safety and health. Examples where respirators may be required are listed below.

<table>
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<tr>
<th>Work Activity</th>
<th>Airborne Contaminant Examples</th>
<th>Exposure Threshold of Consequence</th>
<th>Minimum Respiratory Controls</th>
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<tbody>
<tr>
<td>Confined space entry into sewer man holes, and large chemical tanks</td>
<td>Oxygen deficiency</td>
<td>&lt;19.5% Oxygen</td>
<td>SCBA</td>
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<tr>
<td></td>
<td>Hydrogen sulfide</td>
<td>5ppm (STEL)</td>
<td></td>
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<tr>
<td>Connecting or disconnecting highly toxic gas cylinders in an emergency when other controls have failed</td>
<td>Arsine Bromine Fluorine Phosphine Diborane</td>
<td></td>
<td>SCBA</td>
</tr>
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<td>Clean-up of chemical spills in laboratories where airborne concentration and potential exposure is unknown</td>
<td></td>
<td></td>
<td>SCBA</td>
</tr>
<tr>
<td>Activity Description</td>
<td>Substance</td>
<td>PPE</td>
<td></td>
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<tr>
<td>----------------------</td>
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<tr>
<td>Clean-up of chemical spills where exposure level is known or can be calculated</td>
<td></td>
<td>APR or PAPR with combination cartridge</td>
<td></td>
</tr>
<tr>
<td>Clean-up of unbound engineered nanoparticles</td>
<td></td>
<td>APR or PAPR with HEPA cartridge</td>
<td></td>
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<tr>
<td>Work with mice or rats where local exhaust controls cannot be provided and the user is allergic</td>
<td>Mouse or rat dander</td>
<td>N-95 respirator, APR with HEPA cartridge, or PAPR</td>
<td></td>
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<tr>
<td>Clean-up of hazardous airborne biological materials outside of a vented enclosure</td>
<td>Tuberculosis</td>
<td>N-95 respirator, APR with HEPA cartridge, or PAPR</td>
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<tr>
<td>Changing filters on biological safety cabinets or chemical exhaust systems</td>
<td>Infectious particles or chemical dust</td>
<td>N-95 respirator, APR with HEPA cartridge, or PAPR</td>
<td></td>
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<tr>
<td>Work in visibly moldy environments</td>
<td>Mold spores</td>
<td>N-95 respirator, APR with HEPA cartridge, or PAPR</td>
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<tr>
<td>Asbestos removal work</td>
<td>Friable or airborne asbestos fibers</td>
<td>APR or PAPR with HEPA cartridge</td>
<td></td>
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<tr>
<td>Grinding or sanding lead based paint</td>
<td>Airborne lead</td>
<td>APR or PAPR with HEPA cartridge</td>
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<tr>
<td>Spray painting</td>
<td>Solvents and fine particles</td>
<td>APR with combination cartridge, or PAPR</td>
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<tr>
<td>Stone grinding, drilling or sanding or work with fine silica</td>
<td>Silica dust</td>
<td>APR with HEPA cartridge, or PAPR</td>
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<tr>
<td>Welding</td>
<td>Metal fumes</td>
<td>APR with combination cartridge, or PAPR</td>
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</tbody>
</table>

**IDLH Atmospheres**

For all instances where SCBA are used to protect from IDLH atmospheres, one laboratory worker, or when needed, more than one laboratory worker shall be located outside the IDLH atmosphere. Visual, voice or signal line communication shall be maintained between the laboratory worker(s) inside and outside of the IDLH atmosphere.
Selection of air-purifying filter, cartridge or canister
As part of the Hazard Assessment, ORS staff will make recommendations for the selection of air-purifying filters, cartridges, canisters or SCBA.

Particulate-Filter Units.
The NIOSH 42 CFR Part 84 regulation provides for nine classes of particulate filters: three levels of filter efficiency, each with three categories of resistance to filter efficiency degradation. The three levels of filter efficiency are 95%, 99%, and 99.97%. The three categories of resistance to filter efficiency degradation are labeled N, R, and P.

NOTE: These nine categories apply only to negative-pressure air-purifying, particulate-filter respirators. PAPRs for particulates are approved only with highest-efficiency filters (N100, R100, P100).

Chemical Cartridges: Gas and Vapor Contaminants
In the event that a worker will be exposed to particulates and gases and vapors, combination cartridges are necessary because neither type is adequate for the other contaminant class (i.e., a particulate filter will not afford protection against gases and vapors).

NIOSH-Prohibited Cartridges.
NIOSH prohibits the use of chemical cartridges for the following chemicals because of their toxicity, poor warning properties, reactivity or other hazardous characteristics:

- Acrolein
- Aniline
- Arsine
- Bromine
- Carbon monoxide
- Dimethylaniline
- Dimethyl sulfate
- Hydrogen cyanide
- Hydrogen fluoride
- Hydrogen selenide
- Hydrogen sulfide
- Methanol
- Methyl bromide
- Methyl chloride
- Methylene bisphenylisocyanate
- Nickel carbonyl
- Nitrobenzene
- Nitrogen oxides
- Nitroglycerin
- Nitromethane
- Ozone Phosgene
- Phosphine
- Phosphorus trichloride
- Stibine
- Sulfur chloride
- Toluene diisocyanate (TDI)
- Vinyl chloride
Appendices

Related Information

OSHA: Respiratory Protection

History/Revision Dates

Origination Date: 2008

Last Amended Date: August 11, 2014

Next Review Date: Month, Day, Year