NATIONAL PARK SERVICE
DEPARTMENT OF THE INTERIOR

Conserve O Gram

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An Introduction To Respirator Use In Collections Management

Certain collections management activities can pose inhalation hazards for staff. Inhalation hazards occur whenever a toxic material, whether as a particulate or a vapor, enters a worker's breathing zone. Examples include:

- mercury vapor from ethnographic or natural history objects treated with mercury salts
- paradichlorobenzene or naphthalene vapor from pest control treatments
- ethanol, isopropanol, or formaldehyde vapor from poorly sealed fluid collection jars
- acetone vapor from lacquer used for applying catalog numbers to objects
- acid and solvent vapors from deteriorating cellulose nitrate and acetate films
- biological hazards, such as hantavirus, histoplasmosis, or psittacosis
- dust containing arsenic or DDT from vertebrate or ethnographic collections
- silica from dust-generating processes used in paleontology collections
- fibers, dust mites, insect frass, or fungal spores
- dust from objects contaminated with asbestos or lead

When evaluating potential exposures, consider the amount of chemical or other hazardous material that is used, the length of exposure to the hazard, the toxicity of the material or the virulence of the biological agent, and the possible airborne concentration.

The first line of defense against inhalation hazards is the development of engineering or administrative controls to address the problem. Engineering controls may include fume hoods, at-source dust extractors, or improved ventilation. Administrative controls include: eliminating airborne hazard generation; curtailing or eliminating some activities in the absence of proper engineering controls; using less hazardous materials. Health and safety professionals, such as industrial hygienists, can advise on acceptable engineering and administrative controls for particular situations.

Respirators are **never** the first line of defense against inhalation of hazardous materials: rather, they are used only when engineering or administrative controls are in progress, or when such controls are not feasible. There are many instances in museums and historic sites when engineering controls would not be feasible or would be delayed pending funding, and administrative controls would be impractical. In these circumstances, respirators may be an option.

Respirators are designed to reduce inhalation of airborne hazards, and are part of a class of safety equipment known as Personal Protection Equipment (PPE). Additional PPE (gloves, aprons, eye protection, etc.) may be necessary to prevent absorption or contact with skin or eyes. Selection of any type of PPE depends upon a clear understanding of the nature of the hazards in the workplace. The Occupational Safety and Health Administration (OSHA) standard 29 CFR 1910, Subpart I (1910.132-139) discusses types of PPE (http://www.osha-slc.gov/OshStd_toc/OSHA_Std_toc_1910_SUBPART_I.html>).

Determining When Respirators are Needed

The applicable regulation regarding the use of respirators is 29 CFR 1910.134, (<http://www.osha-slc.gov/OshStd_data/1910_0134.html>). OSHA requires that if an employer exposes employees to a respiratory hazard and/or requires them to wear respirators, the employer must first conduct an exposure assessment. An

assessment is recommended when employees complain of respiratory symptoms, work with materials for which OSHA has a substance specific standard (e.g., lead, asbestos), or when work areas contain visible fumes, dusts, or aerosols. Any NPS staff members who believe that they may be at risk from an inhalation hazard should discuss this possibility with their supervisors and the park Safety Officer, and request an exposure assessment.

Once the need for an assessment is indicated, it is important to identify the contaminants. Are they particulates (aerosols, dusts, fumes), chemical gases/vapors, biological materials (bacteria, fungal spores, viruses), or some combination of these? This is usually followed by employee exposure monitoring to determine if the contaminants pose a risk to worker safety. A discussion of the types of exposure monitoring that have been useful in museum environments can be found in Makos and Dietrich (1995). For many contaminants, there are levels of exposure (TLVs, or threshold limit values, and PELs, or permissible exposure limits) that when exceeded, trigger the need for respiratory protection. Even if exposure limits are below an acceptable level, you may voluntarily use a respirator if its use does not pose a hazard.

Ideally, industrial hygienists or other health and safety professionals will conduct exposure monitoring and air sampling for these assessments. The National Institute for Occupational Safety and Health (NIOSH) will conduct these assessments on request. Where monitoring or sampling is not feasible, it may be possible for park Safety Officers or safety professionals to develop estimates based on physical/chemical properties of the contaminants, and/or on surveys of the same contaminants conducted at other sites.
If it is determined that employees must use respirators, the park must establish a respiratory protection program. It is likely that these are already established in many parks, but have been directed towards maintenance, rather than museum staff. The same program can be adapted to the needs of both groups. Radkte and Garbe (1999) provide sample programs.

Selecting Appropriate Respirators

Respirators will not provide complete protection against airborne contaminants. All have limits of protection. Properly used, they reduce the level of exposure to or below that considered acceptable by present-day standards. Selecting the proper respirator for a particular hazard is fundamental to hazard reduction. The results of the exposure assessment will help collections staff make appropriate choices. Only respirators tested and certified by NIOSH should be used for any application. A list of certified respirators is available at <http://www.cdc.gov/niosh/celhowto.html>.

There are two primary classes of respirators: air-purifying and atmosphere-supplying. Air-purifying respirators remove contaminants from inhaled air, but do not supply oxygen and cannot be used in oxygen deficient atmospheres (less than 19.5% oxygen), or atmospheres considered immediately dangerous to life or health (IDLH). Atmosphere-supplying respirators exclude ambient air and provide clean air from a separate source. Therefore, atmosphere-supplying respirators can be used in oxygen deficient atmospheres. The circumstances in which atmosphere-supplying respirators are necessary require specialized training, and will not be encountered in routine museum work. Air-purifying respirators come in three kinds: particulate respirators, gas and vapor respirators, and combination respirators. Particulate respirators are designated as N (not resistant to oil), R (resistant to oil), and P (oil proof). Each is also rated by filter efficiency (e.g., 95%, 99.97%). For most museum applications the P100 respirator is appropriate. Filters should be replaced whenever it becomes difficult to breathe through them or if they are damaged or soiled. Gas/vapor respirators use replaceable chemical cartridges to protect against specific types of gases or vapors, as noted for each cartridge type. They are effective only until the filtering capacity of the cartridge is depleted. Combination respirators use replaceable cartridges that remove both gaseous and particulate contaminants simultaneously. Like gas/vapor filter cartridges, these must be replaced

when capacity is reduced. Capacity can be affected by conditions of use and storage. Manufacturers supply information on acceptable conditions. Some cartridges are equipped with an end-of-service-life indicator (ESLI) to facilitate change-out schedules.

For additional information see the OSHA website, <http://www.osha.gov>. The website which includes the page Advisor Genius: Selecting an Appropriate Respirator, provides step-by-step guidance in selecting a respirator type for a particular inhalation hazard.

Determining Who Can Wear a Respirator

Not everyone can wear a respirator. Before any employee can wear a tight-fitting facepiece respirator (including disposable or low-maintenance particulate respirators, sometimes called "dust masks"), the employer must provide a medical evaluation. The applicant completes an OSHA questionnaire (which is Appendix C of 29 CFR 1910.134) and is examined by a licensed health care professional. In addition to medical conditions, other limiting factors may be facial hair, some styles of corrective lenses, very prominent cheekbones, facial scars, and chronic claustrophobia. Any person with a known allergy should discuss these concerns during the medical evaluation.

Fit Testing and Respirator Training

Once an employee has been medically approved, and the type of respirator necessary for the work has been determined, the employer will provide fit testing from a selection of certified respirators of the appropriate type from different manufacturers. The employee selects a respirator that seems to fit comfortably and then the fit is tested following the procedures outlined in 29 CFR 1910.134. Fit testing should be repeated annually, more often if there is a change in physical condition, or whenever a different respirator is used. The employee conducts a seal-check each time the respirator is used to insure that it is being worn properly. This procedure is discussed in Appendix B-1 of 29 CFR 1910.134.

As part of the fit testing process, employees will receive training about proper selection, use (including seal checks), maintenance, inspection, and storage of respirators, as well as the general requirements of 29 CFR 1910.134.

All employees who use respirators should keep a copy of their medical evaluation form. The health care professional who signed the form should give dates for which the medical evaluation is valid. Employees should also retain a copy of their fit testing results and a record of filter changes and respirator maintenance activities.

Sources Cited

Makos, Kathryn A., and Elizabeth C. Dietrich. "Health and Environmental Safety." In *Storage of Natural History Collections: A Preventive Conservation Approach*, edited by Carolyn Rose, Catharine Hawks, and Hugh Genoways, 233-252. Iowa City: Society for the Preservation of Natural History Collections, 1995.

Radtke, Tim, and Robert Garbe. *Occupational Health and Safety Written Programs: Respiratory Protection Program.* Lakewood, CO: Office of Managing Risk and Public Safety, Department of the Interior, 1999. Covers all of the basics for a respiratory protection program, including a sample program, available at <http://medical.smis.doi.gov/prog.htm>.

Sources for Additional Information

Gorton, Peter J., Frank J. Schieppatei, Michael A. Cinquino, Mark A. Steinback, Suzanne Vizzini, and Martin Lewars (comps.). *Health and Safety for Archaeologists and CRM Professionals.* Buffalo: Panamerican Environmental, Inc. and Panamerican Consultants, Inc., 1999.

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Johnson, Jessica. "Chapter 11: Curatorial Health and Safety." In *Museum Handbook*, Part I: Museum Collections. Washington, DC: National Park Service, 2001.

Mills, James N., Terry L. Yates, James E. Childs, Robert R. Parmenter, Thomas G. Ksiazek, Pierre E. Rollin, and C. J. Peters. "Guidelines for Working with Rodents Potentially Infected with Hantavirus." *Journal of Mammalogy* 76, no.3 (1995): 716-722.

National Park Service. *Director's Order #50B and Reference Manual #50B,* Occupational Safety and Health Program. Washington, DC: National Park Service, 1999. <http://www.nps.gov/refdesk/DOrders/DOrder50B.html>

National Park Service Hazardous Waste Management & Pollution Prevention Team. *Respiratory Protection, National Park Service Envirofacts.* Washington, DC: National Park Service, 1999.

Sources of Supplies and Equipment

Many laboratory and safety supply companies sell respirators and filter cartridges, in addition to those listed below:

IPCO Safety
128 Wharton Road
Bristol, PA 19007
(800) 827-2338

Lab Safety Supply
PO Box 1368
Janesville, WI 53547
(800) 356-0783
www.labsafety.com

Catharine Hawks
Conservator
2419 Barbour Road
Falls Church, VA 22043

Tim Radtke, CIH
Industrial Hygienist
Department of the Interior
Office of Managing Risk and Public Safety
755 Parfet Street, Suite 364
Lakewood, CO 80215

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