



Ask the Experts

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Do you have a biosafety question and you're not sure whom to ask? Send your questions to the "Ask the Experts" column and I'll get them answered for you. Drawing from my own experience or that of other experts in the field we'll try to compile a thorough and comprehensive answer to your question. Please e-mail your questions to jkeene@biohaztec.com or to the Chief Editor, Barbara Johnson, at barbara_johnson@verizon.net.

Introduction

This month's article may raise some questions and the answer may be controversial to some. The author would welcome any comments, criticisms, or opposing points of view.

Question

What types of respirators should be used to protect laboratory personnel from exposure to infectious aerosols?

Answer

While NIOSH has certified respirators (N-95) for use as protection against airborne pathogenic organisms in the healthcare setting, there is some question as to the efficacy of any respirator for absolute protection against potential microbial exposure. The NIOSH certification is based on the ability of the filter medium to filter out the particulate contamination at a specific rate. It is the N-95 respirator filter medium, not the respirator, that filters out 95% of the airborne particulates. Remember that the respirator must be fit tested and will always leak around the facepiece to some extent. Fit testing is appropriate for testing respirators for use in chemi-

cal settings because there are "Threshold Limit Values" and "Permissible Exposure Limits" for most chemicals; however, there is no TLV or PEL for microbial agents. There are instances where a single viable cell can cause infection in a susceptible individual.

Are any respirators appropriate to ensure protection against exposure to infectious microbial particulates? Although NIOSH has recommended N-95 respirators for use in the "health-care setting," is this same respirator appropriate for those of us who work in laboratories? The concentrations of organisms are several orders of magnitude greater when these organisms are grown in the laboratory than in the clinical setting. Therefore, risk of infection as a result of exposure to infectious agents in the clinical setting is considerably lower than the risk of infection resulting from exposure to the same agent in a laboratory accident. If it takes only one organism, or at the most several, to cause infection in a susceptible host, the use of an N-95 respirator in the laboratory is unlikely to result in any substantial level of protection when an aerosol of infectious culture is released.

Should we then consider using Powered Air Purifying Respirators (PAPR's) in BSL-2 and BSL-3 laboratories to protect personnel against potential exposures? Such action does not seem to be realistic, efficient, or cost-effective. If personnel are properly trained in the hazards of aerosol production, understand the operation and function of the engineering controls that can be provided (biosafety cabinets, centrifuge safety cups, etc.), then the use of PAPR's or any other "respirator" in the BSL-2 or 3 laboratory should not be necessary.

OSHA, and common sense, requires that wher-

ever possible, we engineer out any potential workplace exposures. Therefore, any procedures that are expected to produce aerosols should be contained by some type of mechanical engineering control such as a biosafety cabinet or other device, which has directional air flow away from the worker. The OSHA Respiratory Protection Standard states, "In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section." (U.S. Department of Labor)

There are those who do not fully trust the engineering devices and wish to further protect personnel from potential exposure by providing some type of respirator. Obviously, whenever there is the need for wearing a respirator, the requirements of the OSHA Respiratory Protection Standard must be followed.

If the employer feels that there is no need to use a respirator, employees may still elect to use one. The requirements for the employer under these circumstances are covered by CFR1910.134(c)(2) of the Standard, which states, "An employer may provide respirators at the request of employees or permit employees to use their own respirators, if the employer determines that such respirator use will not in

itself create a hazard. If the employer determines that any voluntary respirator use is permissible, the employer shall provide the respirator users with the information contained in Appendix D to this section (Information for Employees Using Respirators When Not Required Under the Standard)."

Respirators are an effective method of protection against designated hazards when properly selected and worn, but they have limitations. Sometimes personnel request respirators, even when they are not actually necessary. Generally, they are provided to insure an additional level of comfort for workers. However, the employee should be aware of the respirator's limitations and should understand that the first line of defense for protection is not the respirator but the work practice and the available engineering controls. If your laboratory personnel are concerned about possible exposures to infectious aerosols, the first thing to do is to review their work practices and insure that they have appropriate engineering devices for the work being done. Education of the employee as to the operation and function of the engineering controls, particularly biosafety cabinets, is of utmost importance.

In most laboratories, if respirators are really required for protection against exposure to microbial aerosols, there is a failure of either work practices, training, or engineering controls.

Reference

U.S. Department of Labor, Occupational Safety and Health Administration, Respiratory Protection Standard, 29CFR1910.134(a)(1).