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Respirator User with Breathing Air from Independent Sources of the Ambient Atmosphere

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Abstract

The Maximum Use Concentrations for respirators is calculated by multiplying the Assigned Protection Factors for the respirator by the permissible exposure limit. The Maximum Use Concentrations is the upper limit at which the class of respirator is expected to provide protection. Whenever the exposures approach the Maximum Use Concentrations, then the employer should select the next higher class of respirators for the employees. Employers must not apply Maximum Use Concentrations to conditions that are immediately dangerous to life or health, instead, they must use respirators listed for immediately dangerous to life or health conditions of this standard. When the calculated Maximum Use Concentrations exceeds the immediately dangerous to life or health level for hazardous substances or the performance limits of the cartridge or canister, then employers must set the maximum Use Concentrations at that lower limit.

Keywords: Performance limits; Respiratory Protection; Employee health; Radiological contaminants; Legionnaire's Disease

Introduction

Under the Respiratory Protection standard, Assigned Protection Factors and Maximum Use Concentrations are used specifically in selecting proper equipment, which addresses the selection of respiratory protection equipment for non-immediately dangerous to life or health atmospheres. In this provision, employers must provide respirators that are adequate to protect employee health and ensure compliance with all other Occupational Safety and Health Administration requirements under routine, and reasonably foreseeable, emergency situations. Employers must select respirators according to Assigned Protection Factors, Assigned Protection Factors [1]. Employers must select respirators after considering the Maximum Use Concentrations in their workplace under which respirators are to be used. Assigned Protection Factors are used to select the appropriate class of respirators that will provide the necessary level of protection. The airborne hazardous exposure can be from a particulate or a gas or vapour. The Assigned Protection Factors for the class of respirators will remain the same. The Assigned Protection Factor value can only be applied to a class of respirators when the respirators are properly selected and used in compliance with the Respiratory Protection standard, with properly selected filters or canisters, as needed [2]. You need different types of filters, cartridges, and canisters depending on whether dusts, fumes, mists, vapours, or gases are present in your workplace and depending on the kinds and concentrations of the substances present. Respiratory hazards may be present in the workplace whenever an atmosphere does not contain sufficient oxygen, or if it contains chemical, biological, or radiological contaminants in sufficient quantity to harm the health of employees. Respiratory hazards may be present in the workplace in the following physical forms, Dusts and fibres are solid particles that are formed or generated from solid materials through mechanical processes such as crushing, grinding, drilling, abrading or blasting. Examples are lead, silica, and asbestos.

Methodology

Fumes are solid particles that are formed when a metal or other solid vaporizes and the molecules condense in cool air. Examples are metal fumes from smelting or welding. Fumes also may be formed from processes such as plastic injection or extrusion moulding. Mists are tiny droplets of liquid suspended in the air [3]. Examples are oil mist produced from lubricants used in metal cutting operations, acid mists from electroplating, and paint spray mist from spraying operations. Gases are materials that exist as individual molecules in the air at room temperature. Examples are welding gases, such as acetylene and nitrogen, and carbon monoxide produced from internal combustion engines [4]. Vapours are the gaseous form of substances that are normally in the solid or liquid state at room temperature and pressure. They are formed by evaporation. Most solvents produce vapours. Examples include toluene and methylene chloride. Biological hazards include bacteria, viruses, fungi, and other living organisms that are respirable and can cause acute and chronic infections. Examples include Legionnaire's Disease and animal waste products. Effective Protection Factor study, a study, conducted in the workplace, that measures the protection provided by a properly selected, fit tested, and functioning respirator when used intermittently for only some fraction of the total workplace exposure time i.e., sampling is con-ducted during periods when respirators are worn and not worn. Effective Protection Factors are not directly comparable to Workplace Protection Factor values because the determinations include both the time spent in contaminated atmospheres with and without respiratory protection, therefore, Effective Protection Factors usually underestimate the protection afforded by a respirator that is used continuously in the workplace [5]. Program Protection Factor study, a study that estimates the protection provided by a respirator within a specific respirator program. Like the Effective Protection Factor, it is focused not only on the respirator's performance, but also the effectiveness of the complete respirator program [6]. Program Protection Factors are affected by all factors of the program, including respirator selection

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and maintenance, user training and motivation, work activities, and program administration. Workplace Protection Factor study, a study, conducted under actual conditions of use in the workplace, that measures the protection provided by a properly selected, fit tested, and functioning respirator, when the respirator is worn correctly and used as part of a comprehensive respirator program that is in compliance with Occupational Safety and Health Administration Respiratory Protection standard. Measurements of Co and Ci are obtained only while the respirator is being worn during performance of normal work tasks i.e. samples are not collected when the respirator is not being worn [7]. As the degree of protection afforded by the respirator increases, the Workplace Protection Factor increases. Simulated Workplace Protection Factor study, a study, conducted in a controlled laboratory setting and in which Co and Ci sampling is performed while the respirator user performs a series of set exercises. The laboratory setting is used to control many of the variables found in workplace studies, while the exercises simulate the work activities of respirator users. This type of study is designed to determine the optimum performance of respirators by reducing the impact of sources of variability through maintenance of tightly controlled study conditions [8].

Discussion

In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapours, 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 [9]. When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section. Respirators shall be provided by the employer when such equipment is necessary to protect the health of the employee. The employer shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protection program which shall include the requirements [10]. Air-purifying respirator means a respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element [11]. Assigned protection factor means the workplace level of respiratory protection that a respirator or class of respirators is expected to provide to employees when the employer implements a continuing, effective respiratory protection program as specified by this section. Atmosphere-supplying respirator means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes suppliedair respirators and self-contained breathing apparatus units [12]. Canister or cartridge means a container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container. Demand respirator means an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the face-piece by inhalation. Emergency situation means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant. Employee exposure means exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection [13]. End-of-servicelife indicator means a system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective. Escape-only respirator means a respirator intended to be used only

for emergency exit. Filter or air purifying element means a component used in respirators to remove solid or liquid aerosols from the inspired air. Filtering face piece means a negative pressure particulate respirator with a filter as an integral part of the face piece or with the entire face piece composed of the filtering medium. Fit factor means a quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn [14]. Fit test means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. Helmet means a rigid respiratory inlet covering that also provides head protection against impact and penetration. High efficiency particulate air filter means a filter that is at least efficient in removing mono-disperse particles of micro-meters in diameter. Hood means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso. Immediately dangerous to life or health means 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. Interior structural fire fighting means the physical activity of fire suppression, rescue or both, inside of buildings or enclosed structures which are involved in a fire situation beyond the incipient stage. Loose-fitting face piece means a respiratory inlet covering that is designed to form a partial seal with the face. Maximum use concentration means the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator, and is determined by the assigned protection factor of the respirator or class of respirators and the exposure limit of the hazardous substance. The Maximum Use Concentrations can be determined mathematically by multiplying the assigned protection factor specified for a respirator by the required Occupational Safety and Health Administration permissible exposure limit, short-term exposure limit, or ceiling limit.

Conclusion

When no Occupational Safety and Health Administration exposure limit is available for a hazardous substance, an employer must determine an Maximum Use Concentrations on the basis of relevant available information and informed professional judgment. Negative pressure respirator means a respirator in which the air pressure inside the face piece is negative during inhalation with respect to the ambient air pressure outside the respirator. Oxygen deficient atmosphere means an atmosphere with oxygen content below by volume.

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Conflict of Interest

None

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