Respirator Change Out Schedules

Introduction

Respirators are among the most important pieces of safety equipment available. With chemical cartridges, they can be used to filter out and protect workers from many different hazards. The media used in these chemical cartridges is typically activated carbon which adsorbs a number of different chemicals. However, the adsorption capacity is limited. Recently, OSHA has addressed this issue in its revised respiratory standard. It is no longer acceptable to rely on odor thresholds and other warning properties as the primary way of determining cartridge life. Fortunately for employers, there are three options available to help them comply with this new standard.

Background

The revisions to the OSHA standard, 29CFR 1910.134, became effective as of April 8, 1998.

29 CFR 1910.134(d)(3)(iii)(B)(2) states, "If there is no ESLI [end-of-service-life indicator] appropriate for conditions in the employer's workplace, the employer implements a change schedule for canisters and cartridges based on objective information or data that will ensure the canisters are changed before the end of their service life."

Simply stated, chemical cartridges must be equipped with a NIOSH-approved end of service life indicator (ESLI). This is an area on the cartridge that changes color when its time to replace the cartridge. If the cartridge does not have this indicator, employers must develop and enforce a change schedule based on reliable information. Currently, there are very few cartridges equipped with these NIOSH-approved ESLIs. To comply with the new standard, employers must develop their own change schedules, but they do not have to search for and analyze test data themselves. Employers can simply acquire information from other sources that have the expertise to develop change schedules. The employers must then include the source for this information in their written respiratory program. If no information can be obtained to develop an accurate change schedule, the employees must use a supplied air system.

Steps to Develop Change Schedules

1. Gather MSDSs for all the chemicals in the workplace.
2. Determine which, if any, hazardous chemicals may be present in the workplace.
3. Determine the products and the by-products of chemical processes and/or reactions.

**If there is a possibility of unknown contaminates, you must use supplied air.

4. Conduct sampling to determine the concentration levels of contaminants.
5. Determine the breathing rate of the employees using the respirators.
6. Determine the workplace temperature and humidity.

Once these pieces of information are gathered, a change schedule can be developed by using one of the following methods.

Methods For Developing Change Schedules

There are three valid methods employers can use to determine the change schedules for chemical cartridges.

1. Conduct Experimental Tests

Once all pertinent information has been gathered about the workplace and the contaminants, experimental testing can be performed. This can be done by either the end user or an outside consultant or laboratory. The experimental testing will determine the service life of the cartridges. A safety factor must then be applied to this service life information to account for variances in actual workplace conditions. Currently, there is no set protocol for performing this service life testing. For more information, see: www.osha-slc.gov/SLTC/respiratory_advisor/testing/testing.html

For most employers, conducting their own experimental tests on compounds is simply not a realistic alternative. Many employers do not have the capability or the resources to perform these tests. However, for those employers that do, this is the most reliable method to determine cartridge life, especially when dealing with multiple contaminants.

2. Use Manufacturer's Recommendations

These recommendations could come from either the chemical supplier or, more likely, the respirator manufacturer. This method is not as reliable as conducting your own tests but is still a good alternative. Unfortunately, respirator manufacturers may not have information for your specific chemicals or compounds.

3. Use Mathematical Models

There are two ways to approach the mathematical model. It can either be performed by using computer programs or complex mathematical formulas. The computer programs are available on-line or by using CD-ROMs from some manufacturers. If those resources aren't available to employers, the mathematical models can still be used by following complex formulas. The mathematical models are broken down into two categories: predictive models and descriptive models. Each model has its own mathematical formula.

- **Predictive Model:** A copy of the predictive model developed by G.O. Wood can be found on the Internet at www.osha-slc.gov/SLTC/respiratoryprotection/woodmodel.html. This model looks at chemical and physical properties of different compounds to determine cartridge life. However, this model is the least accurate method because it does not look at actual experimental data.
- **Descriptive Model:** A copy of the descriptive model can be found at www.osha-slc.gov/SLTC/respiratoryprotection/yoonmodel.html. The descriptive model looks at existing experimental data to set up a basic model. Once this model has been set up, it can be used to calculate values for points where experimental data is not available.

The descriptive model looks at actual experimental data, making it somewhat more accurate than the predictive model. However, both models still have several drawbacks. First, they rely heavily on experimental data, thus reducing the level of accuracy. Secondly, these equations are very complex, making human error a large concern. And lastly, these models only work well when you are dealing with single contaminant situations.

One tool that can be used to help estimate organic vapor cartridge life is the "Rule of Thumb" method. This method is from chapter 36 of the AIHA publication "*The Occupations Environment - Its Evaluation and Control*". The rule of thumb is:

- If the concentration of the chemical is less than 200 ppm and the chemical's boiling point is greater than 70°C, you can expect a service life of eight hours at a normal work rate.
- Service life is inversely proportional to work rate.
- Reducing concentrations by a factor of 10 will increase the service life by a factor of five.
- Humidity above 85% will reduce service life by 50%.

Note:** This should NOT be the sole method of determining service life. It can only be used as a guide.

Although it is no longer acceptable to use the warning properties of the chemicals as the only means of determining when to change cartridges, if odor is detected at any time, the cartridges must be replaced.

Sources for More Information

Manufacturers with Cartridge Service Life Information:

3M www.3m.com
Aearo AOSafety . . . . . www.aearo.com
Lab Safety Supply Brand (US Safety). . www.ussafety.com
MSA Homepage . . . . . www.msanet.com
North Safety . . . . . www.northsafety.com
Protech. . . . . Charts available, call 1-888-277-7222
Scott. . . . . Charts available, call 1-800-247-7257
Survivair . . . . . www.survivair.com
Willson/GPT . . . . . www.bacou-dalloz.com

Miscellaneous Web sites for More Information:

OSHA 29 CFR 1910.134	www.osha-slc.gov/OshStd_data/1910_0134.html
OSHA Logic Flowchart	www.osha-slc.gov/SLTC/respiratory_advisor/change_schedule.html
OSHA Respirator Info.	www.osha-slc.gov/SLTC/respiratoryprotection/changeout.html

