

OSHA Clarifies Respirator Selection For Diisocyanates

Air-purifying respirators can be used safely and effectively to reduce exposures to common diisocyanates.

by Larry L. Janssen, CIH

When OSHA revised its respiratory protection regulation (29 CFR 1910.134) in 1998, one of the most significant provisions requires most employers who use gas or vapor air-purifying respirators to develop cartridge change schedules based on objective information or data. This provision applies whether or not the contaminant has adequate warning properties:

“Where an effective change schedule is implemented, air-purifying gas and vapor respirators may be used for hazardous chemicals, including those with few or no warning properties.”

While no chemicals are excepted by the regulation or the compliance directive, some users were still uncertain whether air-purifying respirators can be used for common diisocyanates such as toluene-2,4-diisocyanate, hexamethylene-1,6-diisocyanate and methylene bisphenyl isocyanate. OSHA has clarified its position on this issue in a letter dated July 18, 2000, indicating that air-purifying respirators may be used if all requirements of 1910.134 are met and other potential hazards are addressed. The letter is available at www.3M.com/occsafety/html/fregulations.html.

Historically, supplied-air respirators have been used for exposures to common diisocyanates. This was expected because OSHA's original respiratory protection regulation used a decision logic that did not allow air-purifying respirators to be used for protection against gases or vapors with poor warning properties. A contaminant is said to have adequate warning properties if it has persistent odor or irritation effects at concentrations at or below the exposure limit. Reported odor thresholds for



OSHA permits air-purifying respirators for protection against common diisocyanates if all requirements of respirator standard 1910.134 are met and other potential hazards are addressed.

diisocyanates range from two to more than 10 times their exposure limits. Therefore, diisocyanates have poor warning properties.

Misconceptions

If the revised respiratory protection regulation requires cartridge change schedules to be used instead of reliance on warning properties, why have some been concerned about the suitability of air-purifying respirators for diisocyanates? It seems that their concerns are based on one or more of four misconceptions:

Misconception No. 1: Air-purifying respirators should not be used because diisocyanates have poor warning properties.

Although OSHA specifically permits change schedules *in lieu of* sensory warning properties, some health and safety professionals argue this is not a safe practice. They believe diisocyanates could enter a facepiece through a spent cartridge or defect (e.g., a torn exhalation valve), and the user would be unaware, risking prolonged exposure. In reality, this potential exists for any gas or vapor with poor warning properties and for all par-

ticulate contaminants.

In addition, the fact that a contaminant has adequate warning properties does not ensure that all respirator users will be able to detect it at or below the exposure limit. Because odor thresholds are median values for a population, more than half of individuals will not detect the odor until the level is above the reported odor threshold.

A sound respiratory protection program minimizes the risk of undetected exposure by ensuring that respirators

are properly fitted, maintained and worn, and that cartridges are changed at appropriate intervals.

Misconception No. 2: Air-purifying respirators cannot remove diisocyanates.

In fact, it has been known for many years that diisocyanates are adsorbed by activated carbon and retained extremely well. Cartridge breakthrough equations predict very long service lives for diisocyanates under plausible use conditions.

If a diisocyanate is the only air contaminant present, a cartridge change schedule will most likely be based on general hygiene and maintenance considerations rather than breakthrough concerns. If other organic vapors are present in the same atmosphere as a diisocyanate, those vapors invariably break through first.

Cartridge change schedules will be established using a predicted breakthrough of the other contaminant(s).

It must be recognized that diiso-

New NIOSH Policies Support OSHA Respirator Standard

Taken as a whole, OSHA's revised respiratory protection regulation, 29 CFR 1910.134, represents a major step forward in the use of respirators. Confusion was created, however, because some provisions of the new regulation conflict with traditional respirator use practices.

Most of these traditional practices had one of three origins:

- The previous version of 1910.134;
- Limitations placed on respirators by their approvals; or
- Recommendations from "third party" organizations, including the American National Standards Institute and the National Institute for Occupational Safety and Health (NIOSH).

NIOSH's status is unique because it has regulatory authority for respirator approval, but can only make recommendations regarding respirator use. Because not everyone recognizes that NIOSH's function is largely advisory, some were especially concerned when the new OSHA standard conflicted with existing NIOSH recommendations. Fortunately, these discrepancies have been resolved by two NIOSH policy statements issued Aug. 4, 1999. The policies endorse essentially all new provisions of 1910.134. They are available in their entirety at www.3M.com/occsafety/html/fregulations.html. This article will summarize the policies and briefly discuss their significance.

NIOSH Policy on Saccharin Use

The first policy statement is titled "Saccharin Use for Respirator Fit Testing" and describes NIOSH's new position on this topic.

In the past, NIOSH recommended against the use of saccharin because it was viewed as a potential occupational carcinogen. Previous NIOSH guidelines held that no exposure to any carcinogen was acceptable, regardless of how small the risk.

In developing the new policy, NIOSH reviewed saccharin toxicity and calculated potential risks associated with saccharin use for fit testing. Using very conservative assumptions, NIOSH estimated that saccharin exposure from fit test-

ing would be 4,000 times lower than the "no adverse effect level" for carcinogenicity in rats. It was concluded that the risk to workers from a lifetime of fit tests would be very small, perhaps zero.

Therefore, NIOSH now recommends saccharin and Bitrex* for qualitative fit testing. This is consistent with the revised OSHA respiratory protection standard.

NIOSH Policy on Respirator Use

The second policy statement is simply called "NIOSH Respirator Use Policy." It identifies five differences between previous NIOSH policies and the revised 1910.134. NIOSH's resolution of each of these differences is summarized below.

1. Cartridge Change Schedules

Previous NIOSH policy allowed the use of chemical cartridges for gases and vapors only if:

- The contaminant had adequate warning properties (odor or irritation) that would alert the user that the cartridge was exhausted; or
- Cartridges had an end of service life indicator (ESLI) that would notify the wearer that it was time to change the cartridge.

This policy was consistent with the previous version of 1910.134 and respirator approval regulations. NIOSH 42 CFR Part 84 (formerly 30 CFR Part 11) includes the following limitation on the use of cartridges:

"Not for use against gases or vapors with poor warning properties [except where MSHA (Mine Safety and Health Administration) or OSHA standards may permit such use for a specific gas or vapor] or those which generate high heats of reaction with sorbent material in the cartridge."

The revised 1910.134 allows the use of ESLI, but does not permit reliance on warning properties. Instead, employers are required to determine how long cartridges will last and ensure that they are changed before the end of their service lives. Because of this requirement, 1910.134

* Bitrex is a trademark of Macfarlan Smith Ltd.

cyanates may form condensation aerosols when they are airborne. For this reason, it is generally necessary to use a particulate filter in combination with an organic vapor cartridge.

Misconception No. 3: Air-purifying respirators are not approved for gases and vapors with poor warning properties.

NIOSH supports OSHA's requirement for change schedules and recommends against relying on warning properties. In addition, NIOSH recently directed respi-

rator manufacturers to change the cautionary language on cartridge and canister approval labels and user instructions to be consistent with 1910.134.

Specifically, the statement "do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent" must be changed to "follow established cartridge and canister change schedules or observe ESLI to ensure that cartridges and canisters are replaced before breakthrough occurs."

This new cautionary language must appear on labels for all gas and vapor respirators sold after July 1, 2001. For more information, see the related article titled "New NIOSH Policies Support OSHA Respirator Standard."

Misconception No. 4: Air-purifying respirators should not be used because diisocyanates are sensitizers or are "too hazardous."

There is no doubt the effects of diisocyanate overexposure can be serious, particularly in individuals who become

is the standard that "permit[s] such use for a specific gas or vapor." Rather than identifying specific gases or vapors, OSHA allows the use of cartridges for all gaseous contaminants for which cartridge change schedules can be developed.

The NIOSH policy statement acknowledges that developing change schedules is a new exercise for many respirator users and that some mistakes may be made. NIOSH reasons, however, that there are fewer problems associated with change schedules than with reliance on warning properties because:

- There is a wide variation in individuals' ability to detect the odor of a given contaminant; and
- An individual's ability to detect an odor may change due to extended low exposures to contaminants, colds and other illnesses, and distractions in the workplace competing for the individual's attention.

In other words, the use of change schedules represents a more reliable way to manage the use of cartridge respirators than reliance on warning properties.

Based on this logic, the new NIOSH policy recognizes the use of change schedules and recommends against reliance on warning properties. This is consistent with the revised 1910.134.

2. Irritant Smoke Fit Testing

The revised OSHA respiratory protection standard allows the use of irritant smoke for qualitative fit testing. Since 1993, NIOSH has recommended against the use of this method. This recommendation was made because hydrogen chloride (HCl) concentrations in excess of the exposure limit (EL) can be generated during required fit testing procedures. The EL is a ceiling limit (a concentration never to be exceeded) intended to prevent irritation.

NIOSH has concluded that the fit test protocol in the revised 1910.134 may overexpose test subjects to HCl during the required sensitivity test or if the subject fails the fit test. Therefore, contrary to 1910.134, NIOSH continues to recommend against the use of irritant smoke for fit testing. (See NIOSH Health Hazard Evaluation Report HETA 93-040-2315 for additional information on HCl concentrations generated during irritant smoke fit testing).

3. Saccharin Fit Testing

NIOSH restates its support for the use of saccharin for qualitative fit testing.

4. Voluntary Respirator Use

The new OSHA regulation allows a limited respiratory protection program (or no program at all for filtering facepieces) when respirator use is not required because of overexposure or employer policy (i.e., voluntary use). Before this revision, NIOSH recommended that a complete program be implemented whenever respirators were used, including situations in which respirators were worn voluntarily.

NIOSH now believes that the burden of implementing a full program in the absence of overexposure discouraged employers from allowing voluntary respirator use. The new NIOSH policy statement supports OSHA's voluntary use provisions. Specifically, NIOSH believes that voluntary use will safely reduce worker exposures to concentrations well below established exposure limits.

5. Medical Evaluation – Responsible Person

The revised OSHA standard allows medical evaluation of respirator users to be performed by a physician or other licensed health care professional (PLHCP).

NIOSH is concerned that OSHA's definition of PLHCP does not limit nonphysicians to those who are licensed for independent practice in all health care services required by 1910.134. Therefore, NIOSH recommends that the only nonphysicians responsible for medical evaluation (conducting or supervising) should be nurse practitioners or physician assistants in those states where they are licensed for independent practice. Thus, NIOSH is in partial disagreement with OSHA on this provision.

Conclusion

NIOSH is to be commended for clearly stating its concurrence with nearly all changes to 1910.134. It is encouraging that two important federal agencies, OSHA and NIOSH, are working together to bring respiratory protection program management into the 21st century and to reflect today's technology.

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sensitized. However, this reasoning is contrary to accepted respirator decision logic.

By definition, no respirator is required when exposure to an air contaminant is below the exposure limit. The purpose of a respirator is to reduce an exposure that is *above* an exposure limit to an exposure that is *below* that limit. Diisocyanates have exposure limits. Any res-

pirator that reduces a diisocyanate over-exposure to a concentration below its exposure limit is acceptable. NIOSH changed its long-standing policy of recommending only the “most protective respirators” (e.g., SCBA) for use with carcinogens to reflect this logic.

NIOSH now acknowledges that the entire range of respirators can be considered for protection against carcinogens

with exposure limits. The same respirator decision logic is applicable to all air contaminants, including diisocyanates.

Summary

Air-purifying respirators can be used safely and effectively to reduce exposures to common diisocyanates. Appropriate cartridge change schedules can be developed to ensure cartridges are changed before breakthrough occurs. OSHA is correct in allowing employers to choose air-purifying respirators for diisocyanates if they are appropriate for their workplaces.

As is the case with any other air contaminant, a complete respiratory protection program is necessary to ensure these respirators provide appropriate protection. **OH**

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For More Information ...

Contact these leading manufacturers of respiratory protection products:

Name	Address	Telephone Number
Air Systems International	821 Juniper Crescent, Chesapeake, VA 23320	(800) 866-8100
Dalloz Safety	P.O. Box 622, Reading, PA 19603	(800) 345-4112
Draeger Safety	101 Technology Drive, Pittsburgh, PA 15275	(412) 787-8383
MSA	P.O. Box 426, Pittsburgh, PA 15230	(412) 967-3196
Moldex-Metric	10111 W. Jefferson Blvd., Culver City, CA 90232	(800) 421-0668
Scott Health & Safety	309 W. Crowell St., Monroe, NC 28112	(800) 633-3915
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