



# SOUNDSOURCE™

NO.6-NA-US

## Ototoxic Chemical Exposures

Are there some industrial chemical exposures that can cause hearing loss?

Many common industrial chemicals are ototoxic (poisonous to the ears) and as damaging to employees' hearing as the industrial noise to which they are often exposed. But exposure to noise and ototoxic chemicals at the same time can devastate hearing. That's because the combined effects of chemicals and noise are often synergistic rather than merely additive. Certain medications and drugs—both physician-prescribed and over-the-counter—are ototoxic as well, but this article will focus on chemicals often found in an industrial environment.

Researchers studying the effects of noise on industrial workers found a higher incidence of hearing loss in workers exposed to low levels of noise than workers in an area where the noise levels were higher<sup>1</sup>. However, the workers exposed to the lower noise levels were also exposed to industrial solvents concurrently with the noise, and that made all the difference in the findings. The noise and chemical exposure together increased the risk for hearing loss.



**Honeywell**  
HOWARD  
LEIGHT

| Known Ototoxins          | Possible Ototoxins        | Potential Synergistic Effect with Noise |
|--------------------------|---------------------------|---|
| Styrene (monomer)        | Carbon disulfide          | Carbon monoxide                         |
| Toluene                  | n-Hexane                  | Hydrogen cyanide                        |
| Trichloroethylene        | Xylene (o-,m-,p- isomers) |   |
| Ethyl benzene            |                           |   |
| Lead/Inorganic compounds |                           |   |

Exposure to some chemicals by themselves can cause hearing loss. The worst culprits are organic solvents: benzene, toluene, xylene, styrene, and similar compounds. Phosphate-based chemicals used in farming, gardening, and industrialized agriculture, and some non-benzene carbon compounds, like carbon disulfide and carbon monoxide, also have a profound impact on hearing, as do the vapors and dusts of certain metals, like lead, mercury, manganese, and arsenic.

The inner ear also has primary responsibility for balance function. Ototoxic compounds can affect all of the inner ear structures—not just the hearing part—putting a person at risk for falls from dizziness and vertigo.

Even if noise levels alone don't seem loud enough to cause hearing damage (e.g., < 80 dBA), the synergy with chemicals makes hearing loss more likely with lower noise levels. In any environment where chemicals are being used, wearing hearing protection is good practice even when noise is just below the action level (an earplug with moderate attenuation, such as the Howard Leight Clarity,™ is an excellent choice here), especially where the use of a respirator is required. And wearing a respirator can be as important as wearing hearing protection when it comes to working with ototoxins.

The table above lists known and possible ototoxins from several reviews.<sup>2,3</sup> Permissible exposure limits have not been established for these ototoxins, as there is much individual variability in sensitivity and susceptibility.

The following best practices are adopted by many companies with combined exposures to noise and ototoxic chemicals:

- Because of the synergistic effect of many chemicals with noise, wearing a respirator and hearing protection together is a first-line defense against hearing loss whenever chemicals and noise are present together.
- Employees exposed to even marginal noise levels (for example, 80-85 dBA) together with ototoxins should be considered for inclusion in a company's hearing conservation program.
- Consider monitoring those employees with combined noise and ototoxic chemical exposures more frequently for audiometric testing—perhaps every six months rather than annually—to ensure adequate protection from noise as well as the ototoxic chemical exposure.

*Sound Source is a periodic publication of the Hearing Conservation team of Honeywell Safety Products USA, Inc., addressing questions and topics relating to hearing conservation and hearing protection.*

*WARNING: This document does not provide important product warnings and instructions. Honeywell recommends all users of its products undergo thorough training and that all warnings and instructions provided with the products be thoroughly read and understood prior to use. It is necessary to assess hazards in the work environment and to match the appropriate personal protective equipment to particular hazards that may exist. At a minimum, a complete and thorough hazard assessment must be conducted to properly identify the appropriate personal protective equipment to be used in a particular work environment. FAILURE TO READ AND FOLLOW ALL PRODUCT WARNINGS AND INSTRUCTIONS AND TO PROPERLY PERFORM A HAZARD ASSESSMENT MAY RESULT IN SERIOUS PERSONAL INJURY.*

#### References:

1. Bergstrom, B. & Nystrom, B. (1986). Development of hearing loss during long-term exposure to occupational noise. A 20-year follow-up study. *Scandinavian Audiology*, 15, 227-234.
2. Vyskiocil, A. et al. (2012). A weight of evidence approach for the assessment of the ototoxic potential of industrial chemicals. *Toxicology and Industrial Health*, 28(9):796-819 (Epub 2011 Nov 7).
3. Morata, T. (2004). Ototoxicity: An issue in hearing loss prevention in the workplace. *CAOHC Update*, 16(2), 7-9.

#### Honeywell Safety Products USA, Inc.

900 Douglas Pike  
Smithfield, RI 02917  
www.honeywellsafety.com