

Before you begin:

Review OSHA/NIOSH's bulletin on [Preventing Hearing Loss Caused by Chemical \(Ototoxicity\) and Noise Exposure](#). Note possible ototoxins you may use in your facility. Make sure they note any questions they have about the document while reading it.



Introduction

Ototoxic chemicals can impact the hearing system. These chemicals can cause hearing loss and other related effects, such as tinnitus, with or without concurrent exposure to occupational noise. Employers must be aware of any ototoxic chemicals that may be used by their employees. It is important to train employees to recognize the hazards and implement control measures.

Definitions

Ototoxins: Chemicals that can impact the hearing system, causing hearing loss and other related effects, such as tinnitus. Ototoxic chemicals can cause these effects by reaching the inner ear through the bloodstream and causing injury to the inner ear and connected neural pathways.

Discussion

Hearing loss takes on many different forms, but it all has consequences to your overall well-being. The World Health Organization reports that noise-induced hearing loss is the most common permanent occupational injury in the world. However, noise-induced hearing loss is, in fact, preventable.

An emerging focus within industrial hygiene is ototoxic chemicals, or ototoxins. Ototoxins are chemicals that can impact the hearing system, causing hearing loss and other related effects, such as tinnitus, with or without concurrent exposure to occupational noise. Ototoxic chemicals can cause these effects by reaching the inner ear through bloodstream and causing injury to the inner ear and connected neural pathways. Therefore, it is important to use more than just hearing protection when working with ototoxins – inhalation, ingestion, injection, and skin contact routes of exposure must all be minimized to prevent effects on the hearing system.

While in the presence of noise, ototoxic chemicals cause effects on the hearing system at synergistic, or greater-than-additive, levels. However, although high noise levels can exacerbate ototoxic effects, they are not needed to cause the effects in the first place. This means that even if noise levels are below protective benchmarks (i.e., OSHA Action Level, OSHA Permissible Exposure Limit), ototoxic chemicals can still cause hearing system effects.

Although ototoxic effects are a relatively recent focus, several chemicals have been identified as ototoxic. These chemicals range from pharmaceuticals to solvents to metals and includes substances that workers in several different industries are in close contact with each day. Keep in mind, since research is still limited regarding ototoxins, this list is not comprehensive, and there is limited evidence supporting the ototoxicity of other chemicals.

The first step to mitigating the effects of ototoxic effects is to determine if any ototoxic chemicals are present in your operations. This can be done via a review of Safety Data Sheets (SDSs). Ototoxic effect information is typically is commonly seen in Section 11 of SDSs (Toxicological Information). You may also reach out to the chemical manufacturer if you have any further questions on ototoxicity. Reviewing a list of ototoxic chemicals may also benefit you (see below).

Substance Class	Chemicals
Pharmaceuticals <i>*Ototoxicity at therapeutic doses is limited</i>	Aminoglycosidic antibiotics (e.g. streptomycin, gentamycin) and some other antibiotics (e.g. tetracyclines), Loop diuretics* (e.g. furosemide, ethacrynic acid) Certain analgesics* and antipyretics* (salicylates, quinine, chloroquine) Certain antineoplastic agents (e.g. cisplatin, carboplatin, bleomycin).
Solvents	Carbon disulfide, n-hexane, toluene, p-xylene, ethylbenzene, n-propylbenzene, styrene and methylstyrene, trichloroethylene.
Asphyxiants	Carbon monoxide, hydrogen cyanide and its salts, tobacco smoke
Nitriles	3-Butenenitrile, cis-2-pentenenitrile, acrylonitrile, cis-crotonitrile, 3,3'-iminodipropionitrile.
Metals and Compounds	Mercury compounds, germanium dioxide, organic tin compounds, lead.

Source: CDC/NIOSH Publication Number 2018-124: [Preventing Hearing Loss Caused by Chemical \(Ototoxicity\) and Noise Exposure](#). Reference to specific commercial products, manufacturers, companies, or trademarks does not constitute its endorsement or recommendation by the U.S. Government, Department of Health and Human Services, or Centers for Disease Control and Prevention. The linked publication is freely available on CDC.gov.

Control methods for minimizing both noise exposure and ototoxin exposure include chemical substitution, enclosures, ventilation, worker/process isolation, selective use of noisy equipment, elimination of unnecessary exposure-causing tasks, and PPE (personal protective equipment) such as hearing protection, chemical-protective gloves, arm sleeves, aprons, etc.

Common ototoxin exposures include:

- Benzene – Found in plastics, paints, cleaning materials, cigarette smoke, etc.
- Carbon disulfide – Found in pesticides.
- Carbon monoxide – Found in cigarette smoke, vehicles, cooking stoves, gas-powered tools, etc.
- Styrene – Found in plastics and insulating materials.
- Trichloroethylene – Found in paints, waxes, pesticides, rug cleaners, spot removers, etc.
- Toluene – Found in lacquers, adhesives, rubber, etc.
- Xylene – Found in paints, thinners, etc.

Best Practices at work include:

- Read the labels on your solvents, paints, compounds, and medications and be aware of ototoxic ingredients.
- Wear protective clothing and respiratory protection.
- Consider buying the less hazardous version of whatever you need.
- Periodically monitor your hearing.
- Work and store chemicals in well-ventilated areas.
- Properly dispose of ototoxic materials once finished with projects.

Conclusion

Ototoxic chemicals are present both in occupational settings and at home. These chemicals can cause effects on the hearing system, with these effects exacerbated by the presence of additional noise exposure. Knowing if you are working with ototoxins and methods to reduce your potential exposure can reduce the likelihood of experiencing effects on your hearing.

Group Activity

Without using a reference list, have participants work in groups to list ototoxins that may be present in their work areas. Once each participant has thought of as many ototoxic chemicals as they can, have them review an SDS to see if there are any they have missed. Once this is done, share with the group and discuss methods to reduce exposures.

Resources

[Preventing Hearing Loss Caused by Chemical \(Ototoxicity\) and Noise Exposure \(cdc.gov\)](#)

[Ototoxicant Chemicals and Workplace Hearing Loss | Blogs | CDC](#)



**Bureau of Workers'
Compensation**

Governor Mike DeWine
Administrator/CEO Stephanie McCloud

August 2022

We've got you covered

www.bwc.ohio.gov

