

The ear poisons: **ototoxicants**

The role of noise as a cause of hearing loss is well known. But did you know that exposure to certain substances, classified as ototoxicants, can damage the structures of the ear and result in hearing loss?

The ear, like other organs in the body, requires blood flow for health and proper functioning. Toxic substances circulating in the body can damage the ear the same way they affect the liver, kidneys, and other organs.

A little history

Ototoxicants were discovered as far back as the 19th century, when quinine and chloroquine (treatments for malaria) were found to cause temporary hearing loss. According to the American Speech-Language-Hearing Association, there are more than 200 medicines, both prescription and over the counter, that can cause hearing loss. **Types of ototoxic substances include solvents, asphyxiants, heavy metals, and medications.**

How do ototoxicants damage hearing?

Ototoxicants may act on the ear in several ways. They may damage the auditory nerve fibers that transmit sound vibration to the brain, allowing the brain to interpret sound. Or they may cause direct damage to the hair cells in the inner ear that amplify sound waves and allow us to hear. Ototoxicants may also affect the muscles in the middle ear by reducing their shock-absorbing ability.

How can exposure to ototoxicants occur?

Employees can be exposed to ototoxicants through inhalation, skin, or other direct contact.

Studies show that synergistic effects from combined exposure to noise and ototoxic substances increase the risk of noise-induced hearing loss even when noise exposures are

below the recommended occupational exposure limit (OEL) of 85 dBA (decibels, A-weighted).

The threshold for hearing loss in settings where there may be combined exposures to noise and ototoxicants is unknown.

Annual audiograms are recommended when airborne exposures to ototoxicant chemicals are 50% of the OEL, without the use of respiratory protection. Skin should be protected also, since dermal contact may contribute to exposure.

Even in work environments where there is no overexposure to noise, audiograms are advised when employees are exposed to confirmed ototoxicants such as ethylbenzene, styrene, toluene, or xylene.

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Which industries or workplace activities may involve combined noise and ototoxicant exposures?

- Manufacturing of metal, leather, and petroleum products
- Construction
- Agriculture
- Painting
- Printing
- Boat building
- Furniture making



- Fueling vehicles or aircraft
- Weapons firing
- Firefighting
- Radiator repair
- Pesticide application

How do I assess the risks?

- Check Safety Data Sheets (toxicology section) to determine if ingredients are listed as ototoxic or neurotoxic.
- Evaluate individual employee exposures to ototoxic chemicals.
- Measure employee noise exposures.
- Determine if combined exposures to noise and ototoxicants exist in the workplace.

How can exposures be prevented?

Substitution

- Review use of ototoxic chemicals in the workplace and determine if there are safer alternatives.

Engineering controls

- Install ventilation or other workplace controls to reduce employee exposures to ototoxic chemicals.
- Isolate employees from excessive noise sources.
- Implement use of tools that generate lower levels of noise.

Administrative controls

- Implement a hearing conservation program and conduct audiograms if ototoxic exposures exist in the workplace (especially if combined noise exposures exist).

Personal protective equipment (PPE)

- Require gloves and other PPE to protect employees from exposure to ototoxic chemicals.
- Require appropriately selected hearing protection to reduce employee noise exposures.

Training

- Train all employees who work with ototoxicant hazards as a part of your hazard communication program.
- Ensure employees understand:
 - What an ototoxic chemical can do to the ear and hearing
 - Which chemicals in the workplace are ototoxic
 - That combined noise and ototoxic chemical exposures pose an increased risk for noise-induced hearing loss
 - How to use the protective measures in place

Resources

[USAPHC Fact Sheet on Occupational Ototoxins \(Ear Poisons\) and Hearing Loss](#)

[Preventing Hearing Loss Caused by Chemical \(Ototoxicity\) and Noise Exposure: SHIB 03-08-2018 DHHS \(NIOSH\) Publication No. 2018-124](#)