

INFORMATION SHEET

Hearing loss: the link between noise and ototoxic substances

Exposure to noise in the workplace is a well-established risk to hearing and can result in noise induced hearing loss. A less well known cause of hearing loss is as a result of exposure to ototoxic substances. Ototoxins may harm hearing or compound the damage noise causes.

What are ototoxins?

These substances affect the organs or nerves concerned with hearing and balance. They are absorbed into the bloodstream and can affect the structures and the function of the inner ear and the connected neurological pathways. Some can damage the cochlea – the ear's spiral-shaped cavity and sensing organ that picks up sound (known as cochleotoxicants), others affect the auditory vestibular nerve, which transmits sound and balances information to the brain (vestibulotoxicants), or the auditory cortex, which processes sound in the brain (neurotoxicants).

Ototoxins can be divided into two general classes: workplace chemicals and medication. Currently it is thought that more than 750 different groups of chemicals are potentially ototoxic, but only a few of these have been studied in any depth.

Exposure to ototoxic substances and noise can combine to increase the risk of hearing loss. To mitigate the risk of noise-induced hearing loss it is necessary to establish whether someone is exposed to noise and ototoxic chemicals or pharmaceuticals in isolation, or in combination.

Which substances are ototoxic?

According to studies, the following substances should be considered confirmed ototoxic agents:

Substance class	Chemicals
Pharmaceuticals	Aminoglycosidic (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) and certain antineoplastic agents (e.g. cisplatin, carboplatin, bleomycin)
Solvents	Carbon disulfide, n-hexane, toluene, p-xylene, ethylbenzene, n-propylbenzene, styrene and methylstyrenes, trichloroethylene.
Asphyxiants	Carbon monoxide, hydrogen cyanide, and its salts.
Nitriles	3-Butenenitrile, cis-2-pentenenitrile, acrylonitrile, cis-crotonitrile, 3,3'-iminodipropionitrile
Metals & compounds	Mercury compounds, germanium dioxide, organic tine compounds, lead.

Furthermore, cadmium and arsenic compounds, as well as halogenated hydrocarbons (polychlorinated biphenyls, tetrabromobisphenol A, hexabromocyclododecane and hexachlorobenzene), alkali bromates (at least high dose exposure), and tobacco smoke are strongly suspected of having ototoxic potential.

Pharmaceuticals are usually only a risk to hearing when they are given in very large doses or are very strong, as in the case of some cancer treatments. Staff/ students may not always be absent from work/ study when they are taking such strong or large-dose drugs. Cytotoxic drugs are often used in combination with other medication, which could also have a synergistic effect.

How to identify an ototoxic substance?

Given the current legislation and knowledge surrounding the ototoxicity of substances it may be several years before the term ototoxic appears on Safety Data Sheets (SDS) or a target organ toxicity identifying the ear.

In the meantime, it is advisable to look for terms such as neurotoxicant, cochleotoxicant, or vestibulotoxicant or “may cause damage to the central nervous system” on the Safety Data Sheet.

Ototoxicity – symptoms

The most common symptoms experienced are:

- Tinnitus or ringing in the ears
- Bilateral or unilateral hearing loss
- Dizziness
- Incoordination of movements
- Unsteadiness on your feet
- Oscillating or bouncing vision

Suggested control measures

- Identify any ototoxic substances used;
- Review current controls in place which should already be protecting staff/ students from hazardous substances in relation to the ototoxic substance ensure the risk to users is reduce as low as reasonably practicable;
- Raise awareness of the risks associated with ototoxic substances;
- Include information about the effects of potentially ototoxic drugs in training programmes;
- Encourage staff/ students to discuss any concerns they may have about medication with their doctor or pharmacist and inform the Scientific Safety Team and Occupational Health;
- Report any noisy areas to the Scientific Safety team for review;
- Reduce noise exposure limits for anyone exposed to noise and ototoxic agents as a precautionary measure;
- Consider special labelling for ototoxic substances.

If you have any concerns or require further advice contact the Scientific Safety team:
healthandsafety@swansea.ac.uk