Chemicals and Noise a Hazardous Combination
The role of Ototoxins

It is no surprise that most work-related hearing loss is caused by noise exposure, and that genetics and age can also be contributors. What may not be as well known is that some chemical exposures can pose a potential risk to hearing. Both animal experiments and human studies suggest that certain chemical exposures may cause "ototoxic" effects (damage the hearing and balance functions of the ear). Whilst generally exposure concentrations need to be high, in combination with noise the effect can be significantly increased.

What are ototoxins?
Chemicals that can damage hearing and cause mild to severe hearing loss, tinnitus (ringing in the ears), or deafness. An ototoxin can be ingested, absorbed through the skin, or inhaled into the body. Once in the bloodstream, the ototoxin is circulated to the ear and absorbed by the auditory nerve, damaging the nerve and causing hearing loss. Ototoxins can also cause hearing loss by damaging the cochlear hair cells (as happens in hearing loss caused by noise).

Effects of chemical exposure on skin
Ototoxic chemicals can cause hearing loss on their own, however when combined with noise exposure, the effects can be even more severe. Organic solvents are the most commonly identified chemicals, but others may also be involved (e.g. metals and chemical asphyxiants). The hearing frequencies affected by solvent exposure are different than those affected by noise. Research suggests that solvents may interact synergistically with noise. Even when noise and chemicals are at permissible exposure levels, the impact of a combined exposure can do more damage than a higher exposure to either hazard alone.

PPE System for Skin Protection

- Independent review of PPE for effective worker protection from skin exposure.
- Assessment of where PPE is really needed.
- PPE selection and use plan specific to the workplace.
- In use testing to establish effectiveness of PPE.
- Interactive training on correct techniques for PPE use.
- Yet another support service from EnviroDerm.

Skin Hydration Monitor EDS10

- The proactive and professional approach to skin health surveillance.
- Identify those with damaged skin before the visual signs.
- Use as an educational tool for raising awareness and promoting better practices.
- Highly portable and easy to use.
- All for the low cost of £450 excl. VAT.
Organic solvents are widely used: in automotive and aviation fuels; in plastics industries; as thinners for paints, lacquers and dyes; in the manufacture of detergents, medicines, perfumes, fabric and paper coatings, printing inks, spray surface coatings; and in insect repellents. Keep in mind that in addition to the potential effect on hearing almost all of these chemicals will also represent a potential for systemic damage, i.e. damage to internal organs. Activities where noise and chemical hazards can potentially combine include boat building, construction, firefighting, fueling vehicles and aircraft, furniture making, manufacturing of metal, leather and petroleum products, painting, printing, and weapons firing.

**Challenges**

It may be difficult to determine the ototoxic effects of chemicals, particularly organic solvents, in exposed workers. Workers are usually exposed to a mixture of solvents with various compositions and concentrations, making it difficult to isolate exactly which chemical, and how much exposure to that chemical is causing damage. Also the industrial environments in which there tend to be exposures to both chemicals and high levels of noise make it difficult to differentiate the solvent effect from noise-induced hearing loss.

Although there is no firm guidance on the lowest occupational exposure limits for solvents in relation to their effect on hearing, the current occupational exposure limits as well as hearing conservation programs for solvent-exposed workers may not be adequate.

Whilst there is a considerable body of studies and reports on this issue, there is still much to be done in terms of how we identify and monitor the effect of chemicals that are ototoxins in order to protect our workforce. However, the very fact that chemicals can have this effect indicates how much more complex the management of chemicals in the workplace is and how we need to increase awareness of this complexity.

**Workforce Protection**

- Conduct a hazard assessment
- Remove the source of exposure
- Substitute ototoxins with less hazardous chemicals
- Reduce noise levels
- Wear hearing protection
- Start a hearing conservation program

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**Some chemicals associated with hearing loss**

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Benzene*</td>
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<tr>
<td>Carbon disulphide*</td>
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<tr>
<td>Carbon monoxide</td>
<td></td>
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<tr>
<td>Hydrogen cyanide*</td>
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<tr>
<td>Lead</td>
<td></td>
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<tr>
<td>Mercury</td>
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<tr>
<td>n-Hexane</td>
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<tr>
<td>Solvent mixtures</td>
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<tr>
<td>Styrene*</td>
<td></td>
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<tr>
<td>Toluene*</td>
<td></td>
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<tr>
<td>Trichloroethylene*</td>
<td></td>
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<tr>
<td>Xylene*</td>
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*Note: this is not a comprehensive list, but some more commonly found chemicals.*

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To understand how to effectively control skin hazards attend our “Skin in the Working Environment” course. This course is a practical one-day course that will enable you to create an effective skin management system and includes a copy of the interactive “Guide to Occupational Skin Management”

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