Occupational Ototoxins (Ear Poisons) and Hearing Loss

FACT SHEET 51-002-0713

The Problem

It is a well-known fact that hazardous noise exposure in the workplace can cause noise-induced hearing loss. Occupational ototoxins have not commanded as much attention, yet pose a significant health risk to our workforce.

Ototoxic chemicals either cause hearing loss independently, or work synergistically with hazardous noise to damage the inner ear.

Certain chemical substances show ototoxic effects at high airborne exposure levels but may not be ototoxic in the concentrations observed in typical occupational settings. Some potential ototoxic chemicals may be absorbed through the skin, significantly contributing to the systemic dose if dermal exposures are not properly controlled. Regardless of the mechanism, exposure to certain chemicals, either alone or in concert with noise, results in hearing loss.

Since the exposure threshold for such ototoxic effects is not generally known, audiometric monitoring is necessary to determine if the substance is affecting the hearing of exposed workers. While audiometric data are useful for any worker exposed to any measurable level of a potential ototoxic chemical, annual audiograms are highly recommended for workers whose airborne exposures, without regard to respiratory protection worn, are at 50% or more of the Occupational Exposure Limit (OEL) (more stringent of the Occupational Safety and Health Administration Permissible Exposure Limit or American Conference of Governmental Industrial Hygienist's Threshold Limit Value) for the substance in question, regardless of the noise level. The $\geq$50% OEL, while somewhat arbitrary, will ensure the collection of data from sub-OEL exposures.

If there are dermal exposures to toluene, xylene, n-hexane, organic tin, carbon disulfide, mercury, organic lead, hydrogen cyanide, diesel fuel, kerosene fuel, jet fuel, JP-8 fuel, organophosphate pesticides, or chemical warfare nerve agents, and such exposures may result in a systemic dose equivalent to 50% or more of the OEL, annual audiograms are recommended.

If an employee works routinely with occupational ototoxins, it is incumbent upon the Occupational Health and Industrial Hygiene professionals to be aware of the exposure and consult with Army Hearing Program staff to ensure hearing monitoring occurs.

Armed with this information, audiometric data reviewers should be alert to possible additive, potentiating, or synergistic effects between the exposure to noise and ototoxins and, where possible, recommend controls for reducing the exposure to one or both.

Activities Where Noise and Ototoxins Often Combine

- Painting
- Printing
- Boat building
- Construction
- Furniture making
- Manufacturing of metal, leather and petroleum products
- Fueling vehicles and aircraft
- Firefighters
- Weapons firing
- Radiator Repair
- Pesticide Spraying

Hearing Conservation and Industrial Hygiene and Medical Safety Management
U.S. Army Public Health Command
5158 Blackhawk Road, Aberdeen Proving Ground, MD 21010-5403
410-436-3797/2439 or DSN 584-3797/2439

Potential Ototoxic Chemicals in the Occupational Environment

Hazard Name	Count of U.S. Army Worksite Occurrences	Count of U.S. Army Installations Representative in Worksite Counts
Acrylonitrile	16	8
Arsenic	86	19
Carbon Disulfide	9	3
Carbon Monoxide	2825	69
Chemical Warfare Agents	2494	15
Cyanide	68	9
Ethyl Benzene	475	46
Fuels	1675	57
Heptane	190	36
Mercury Compounds	11	7
Manganese	349	46
Methyl Ethyl Ketone	592	52
n-Hexane	457	43
Organic Tin (Sn)	19	6
Organophosphate Pesticides	3	2
Paraquate	1	1
Lead Compounds	1798	71
Perchloroethylene	103	25
Stoddard Solvent	650	49
Styrene	85	27
Toluene	1303	64
Trichloroethylene	126	28
Xylene	1076	63

Further Reading

European Agency for Safety and Health at Work: Combined exposure to noise and ototoxic substances (Literature Review) Available at: https://osha.europa.eu/en/publications/literature_reviews/combined-exposure-to-noise-and-ototoxic-substances

NIOSH - National Institute for Occupational Safety and Health, Hearing Loss Research (HLR) program. Available at: http://www.cdc.gov/niosh/nas/hlr/whpa_stragGoal4_6.html
(main page) http://www.cdc.gov/niosh/nas/hlr/default.html

NIOSH - National Institute for Occupational Safety and Health, Science Blog: 'Workplace Hearing Loss'. Available at: http://blogs.cdc.gov/niosh-science-blog/2009/11/hearing/

Morata T.C., Chemical Exposure as a Risk Factor for Hearing Loss, JOEM, Vol. 45, Number 7, July 2003. http://www.ncbi.nlm.nih.gov/pubmed/12855908