

What are Ototoxicants?

It is known that exposure to high levels of noise over extended periods of time and in a frequent manner may induce hearing loss, whether it occurs in or outside the work areas. But not only overexposure to noise can adversely affect our hearing. There are some substances that can have similar adverse effects called ototoxicants. The following table provide a list of these substances by category as shown in an OSHA's safety and health information bulleting about chemical ototoxicity¹.

Category	Substance
Solvents	Carbon disulfide, n-hexane, toluene, p-xylene, ethylbenzene, n-propylbenzene, styrene and methylstyrene, trichloroethylene
Metals and Compounds	Lead, mercury compounds, germanium dioxide, organic tin compounds
Nitriles	3-Butenenitrile, cis-2-pentenenitrile, acrylonitrile, cis-crotononitrile, 3,3'-iminodipropionitrile
Asphyxiates	Carbon monoxide, hydrogen cyanide and its salts, tobacco smoke
Pharmaceutical Ingredients	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)

Excluding the pharmaceutical ingredients, most of the substances previously listed can be found in a variety of trades within the manufacturing industry: metal fabrication, plastics manufacturing, boat manufacturing, production of solar cells among others. There are substances like toluene that can be found in most work areas since it is a component of gasoline, and an ingredient of some paints, inks, lacquers, paint thinners, adhesives, cleaning agents and others².

Exposures to some of these substances, in combination with noise, have been found to have a synergistic effect - a more damaging effect to our hearing than the sum of the individual effects of exposures to noise and the substance³. But having any of these substances at your facility **does not automatically mean** that all your employees are at risk. It is all about the employees' exposure to these substances as well as the duration & frequency of such exposures. Other factors to consider are the quantity of the substance

¹ Preventing Hearing Loss Caused by Chemical (Ototoxicity) and Noise Exposure (SHIB 03-08-2018), <https://www.osha.gov/publications/shib030818>

² American Conference of Governmental Industrial Hygienists. *Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices – Toluene*.

³ Meinke, D. K., Berger, E. H., Driscoll, D. P., Neitzel, R. L., & Bright, K. (n.d.). *The Noise Manual*. 6th Edition. American Industrial Hygiene Association, 2022.

used, the type of job task, the ventilation and controls within the work areas (i.e. local exhaust ventilation, job rotation, personal protective equipment, etc.), occupational noise levels among others.

What can employers do?

- Identify if any of these substances (whether it is a raw material or an ingredient/byproduct) are present in your work areas. You can use your company's hazard communication program - whether using the list of hazardous chemicals or through the safety data sheets of the chemicals used at your facility.
- Inform your workers about the hazards related to these chemicals as part of your hazard communication training. Make sure it is well documented.
- Ensure the company's procedures related to the handling of these or any substances are followed. Document any disciplinary actions taken when workers are observed not following your procedures (employee and middle management accountability).
- Determine if the appropriate controls (engineering, administrative or personal protective equipment) are in place – not just in a written standard operating procedure but in the work areas.
- Determine the employee's exposure levels to these substances and/or occupational noise. You would want to know what the employees' exposures levels are instead of an OSHA compliance officer telling you after a visit; especially if they are found to be high or after a workers' compensation claim. You could do this by:
 - Hiring a consultant – preferably a certified industrial hygienist to conduct workers' exposure assessments.
 - Checking if your insurance carrier (workers' compensation and/or property & casualty carrier) offers these services as part of the premium paid for their coverage.
 - Small businesses can request free and confidential services from USF SafetyFlorida – if they agree with the terms and requirements for their services.

Feel free to contact me if you have any questions about this or any other topic related to occupational safety and health.

[Luis F. Pieretti, PhD, CIH, CSP](#)

University of South Florida

lpierett@usf.edu