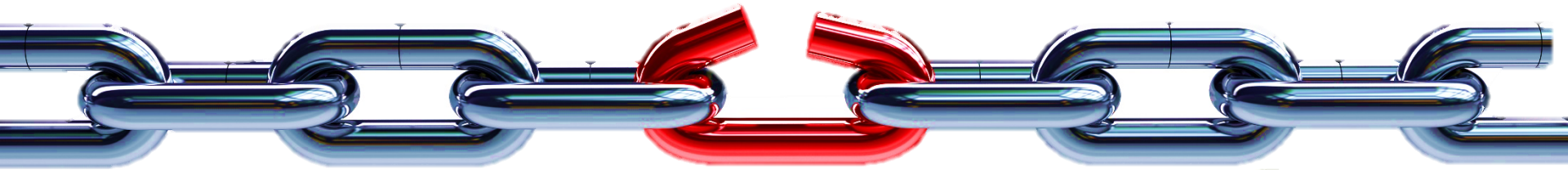
SCIENCE. SERVING PEOPLE.

Ototoxicants…

Identifying A Missing Link in Hearing Loss

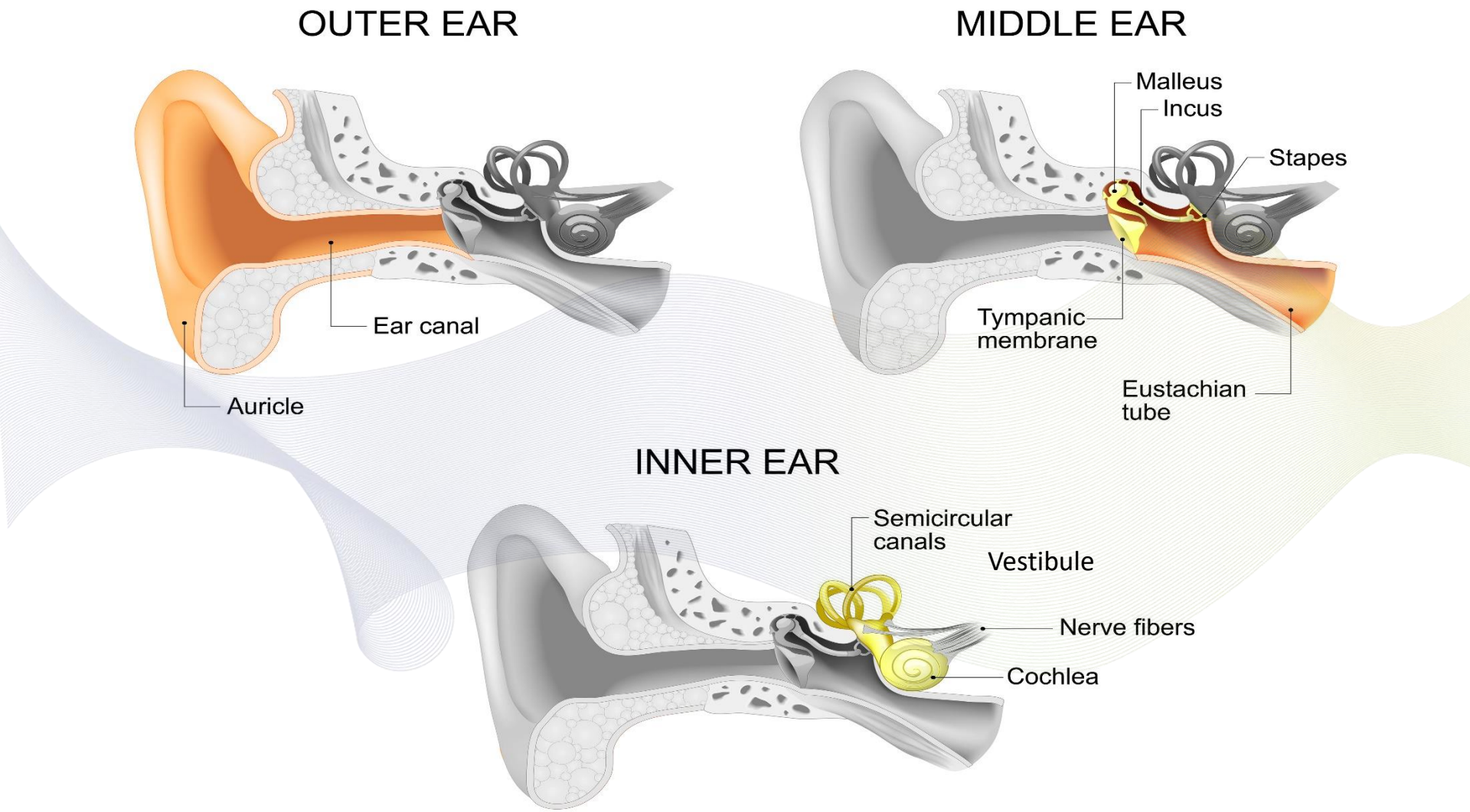


Scenario…

- Noise dosimetry performed
- Noise exposure below the OELs
- Employees having hearing loss

What is happening?

ANATOMY OF THE HUMAN EAR



What are Ototoxicants?

- Ototoxic
  - **Oto**= ear
  - **toxic**= poisonous
- May cause hearing loss or balance problems, regardless of noise exposure

Image © OSHA

Occupational Hearing Loss Etiology

Noise

(Mechanical Damage)

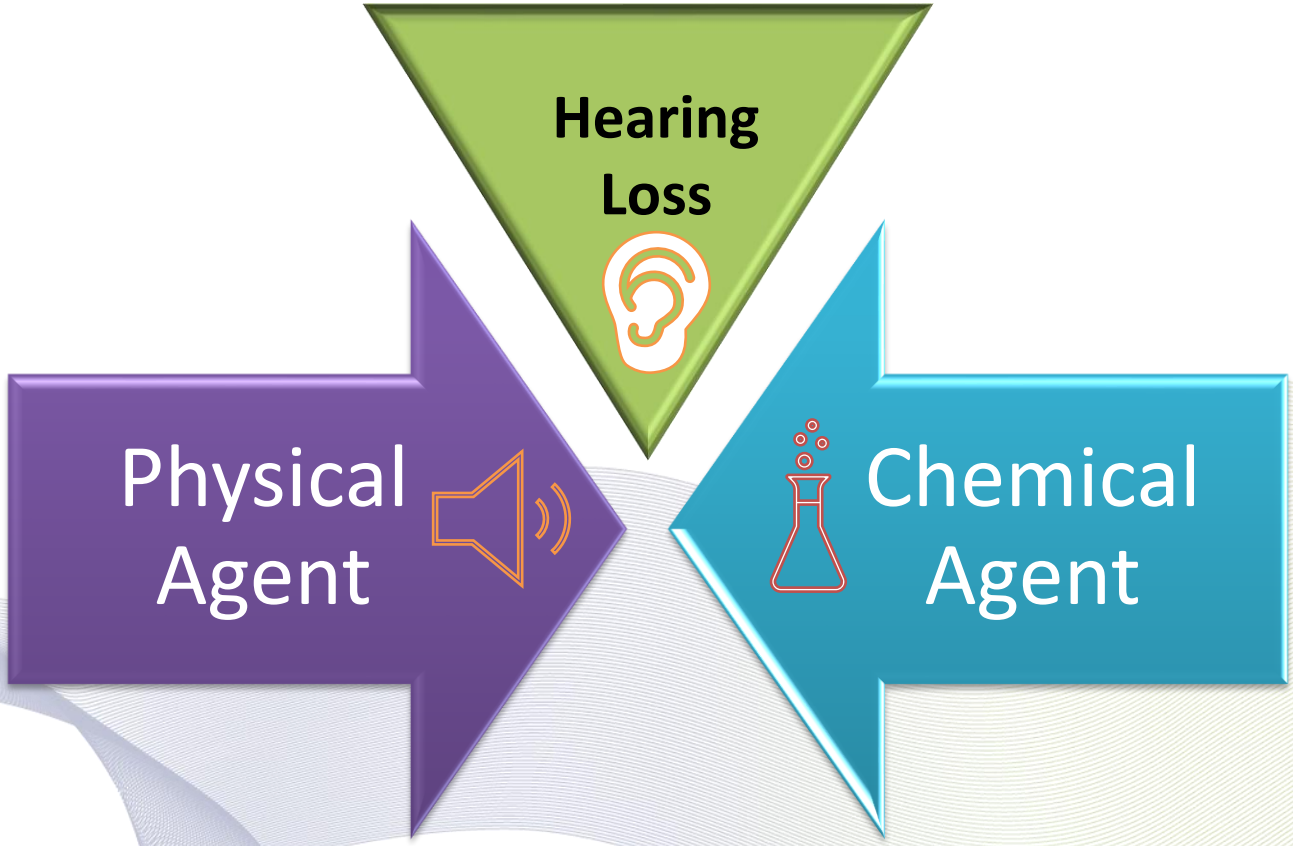
- Recognized for centuries
- Industrialization impact
- Early 20th century - measurement tools
- U.S. military guidelines
- 1970 - OSHA

Ototoxicants

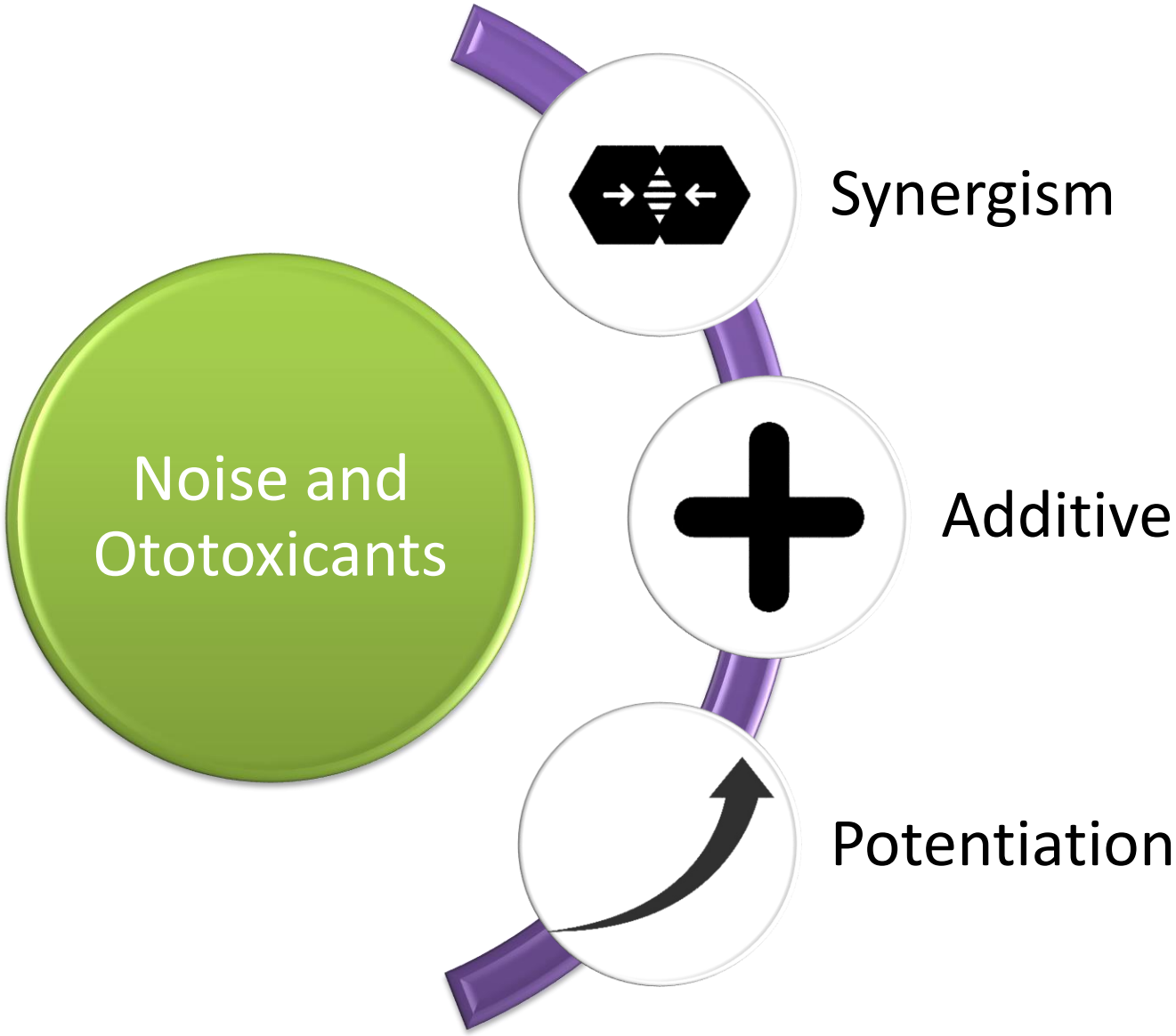
(Metabolic Stress)

- 11th century - Hg vapor
- 19th century - Quinine and chloroquine
- 1970s - Field studies
- 1980s - Synergistic effects studies

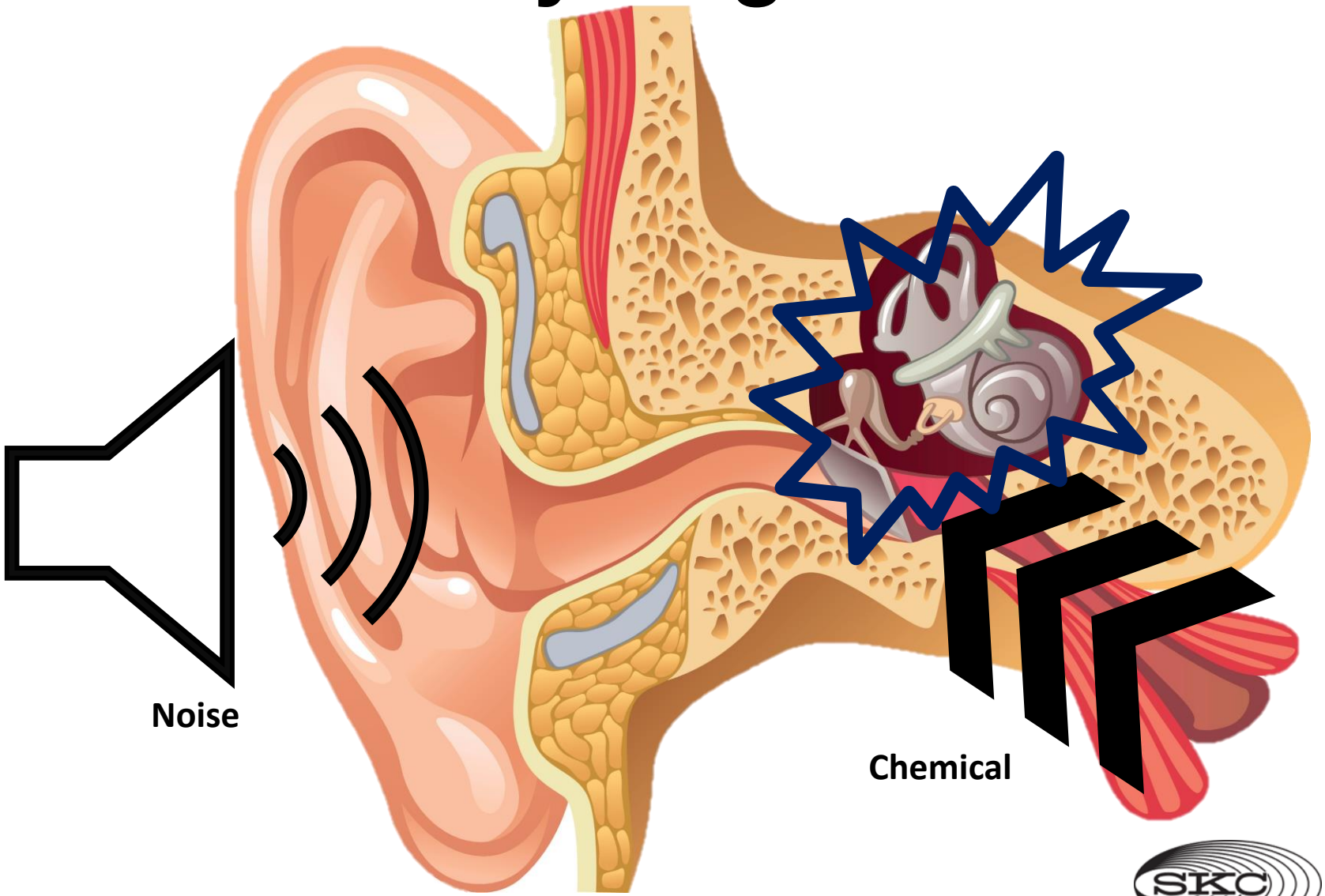
The New Perspective of Hearing Loss



Interactions with Noise



Synergistic Effect



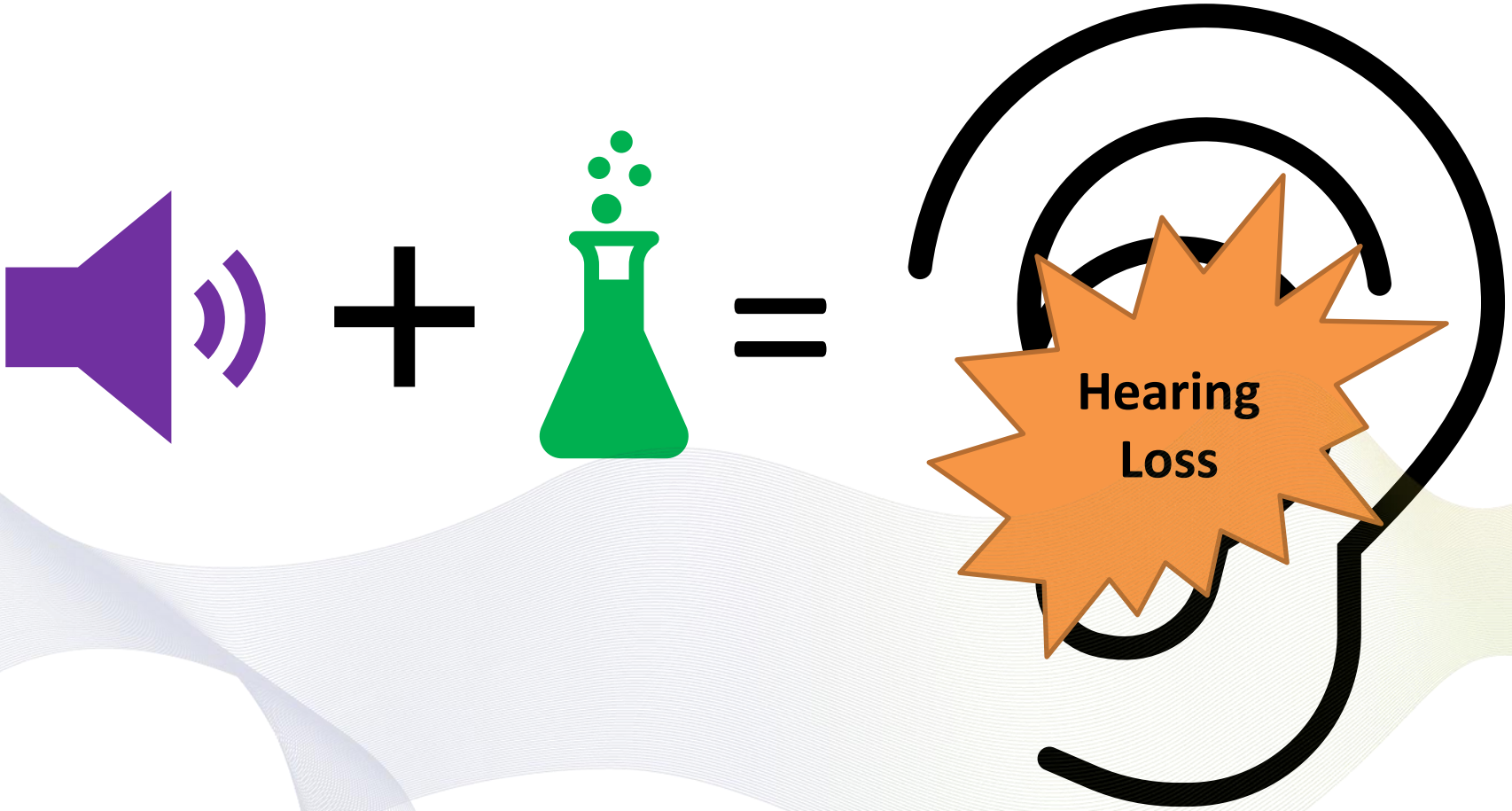
Synergistic Examples

Styrene

Trichloroethylene (TCE)

Toluene

Additive Effect

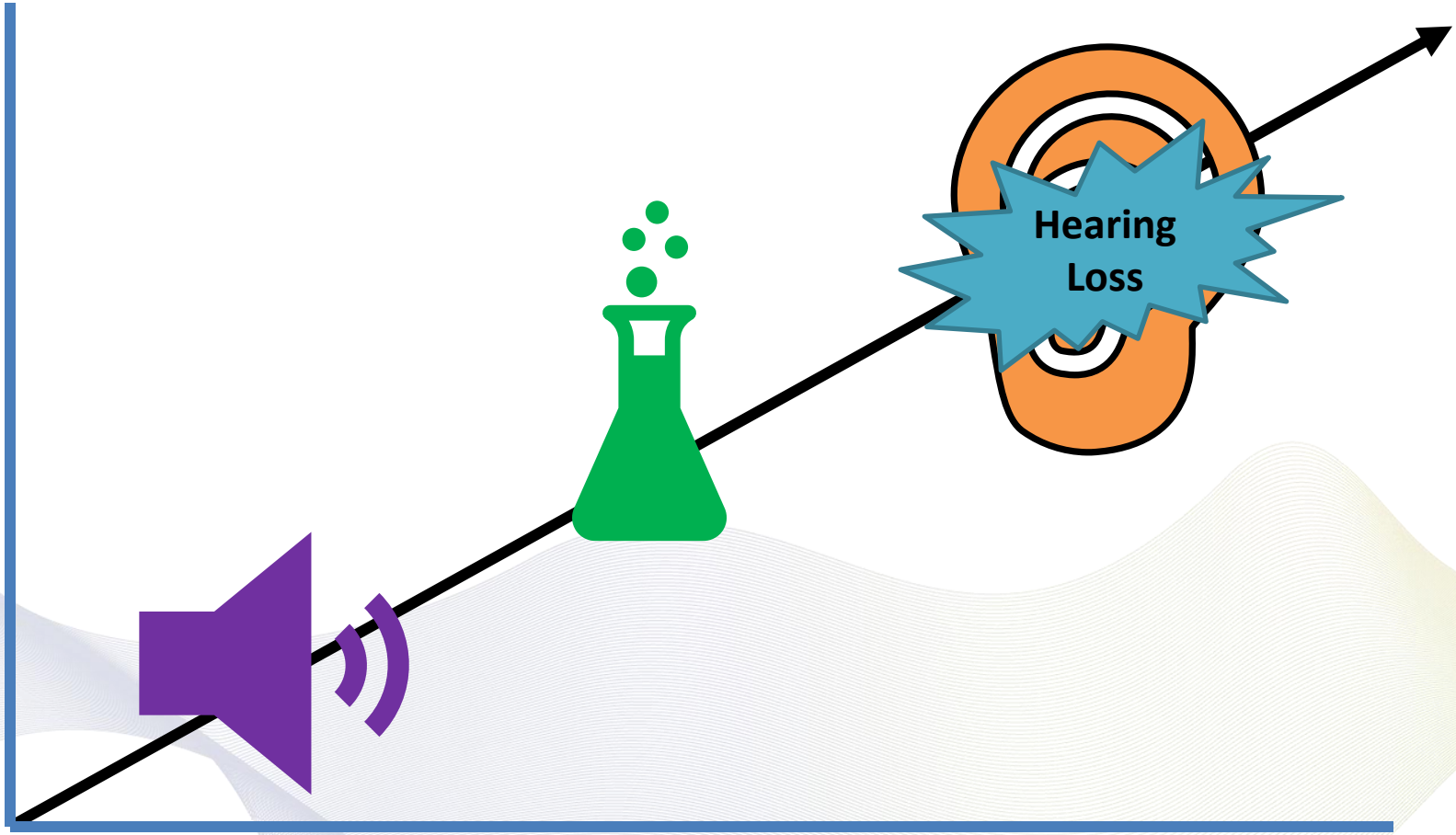


Additive Examples

Ethylbenzene

Lead

Potentiation Effect



Potentiation Examples

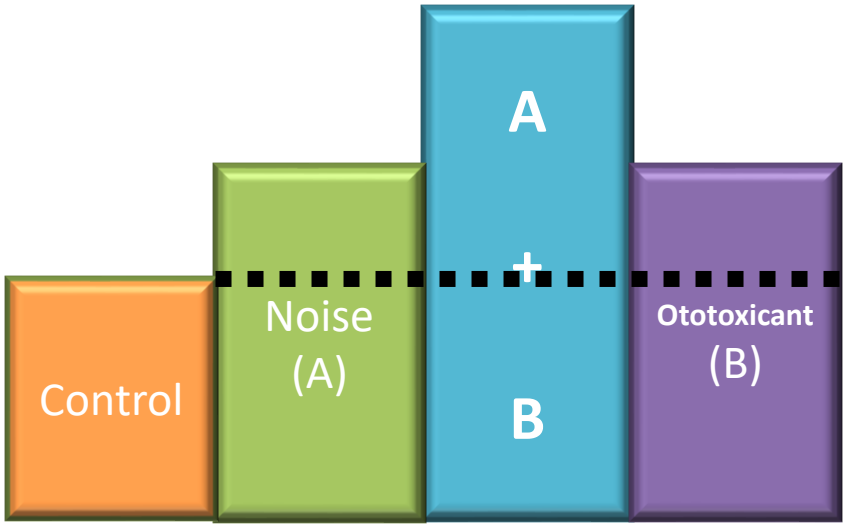
Carbon Monoxide

Hydrogen Cyanide

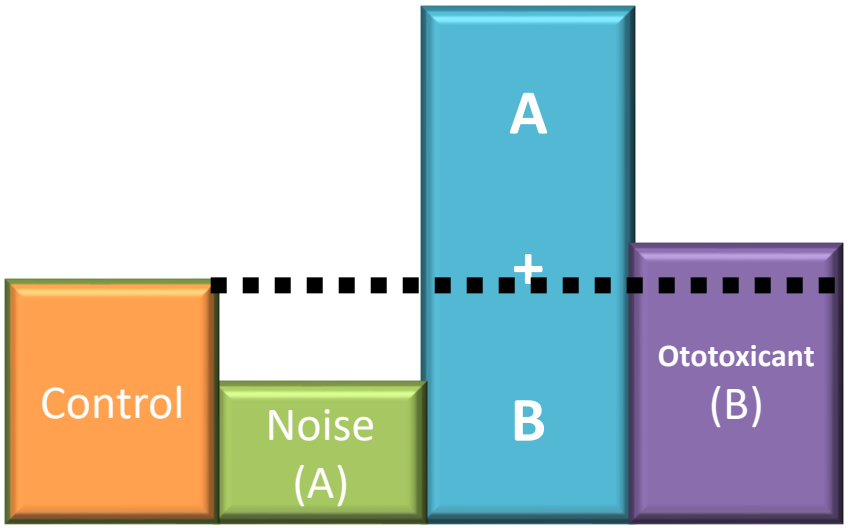
Acrylonitrile

Systemic Asphyxiants

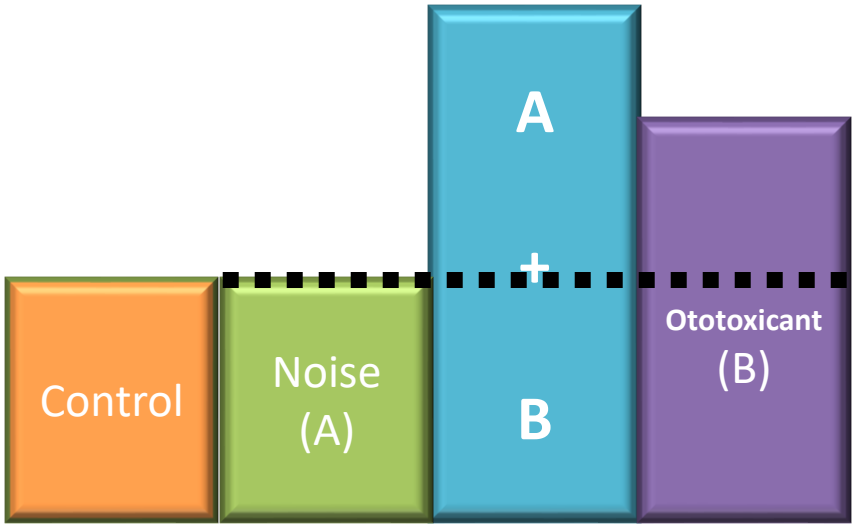
Combined Effects



Additive Effect



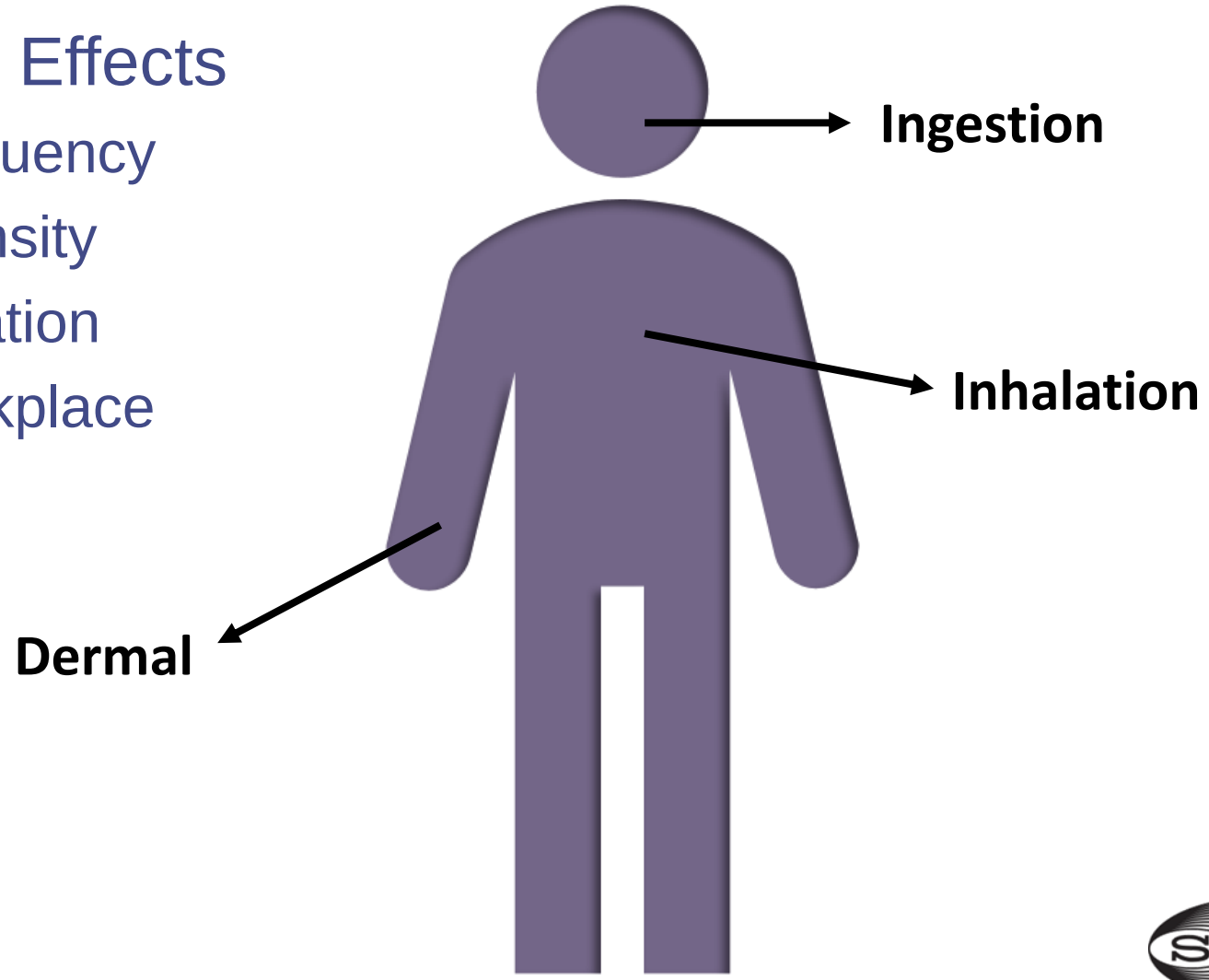
Synergistic Effect



Potentiation Effect

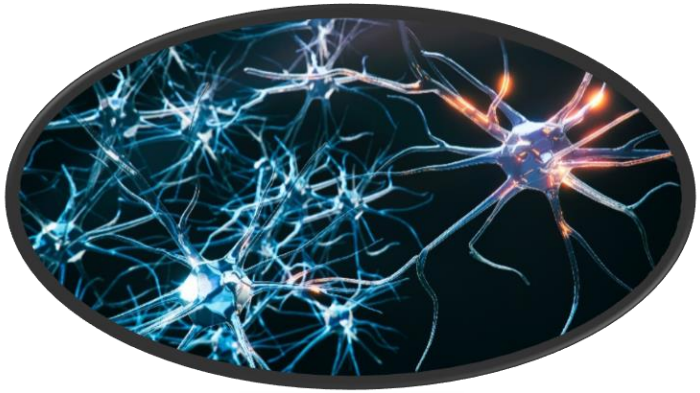
Ototoxicants

- Health Effects
  - Frequency
  - Intensity
  - Duration
  - Workplace

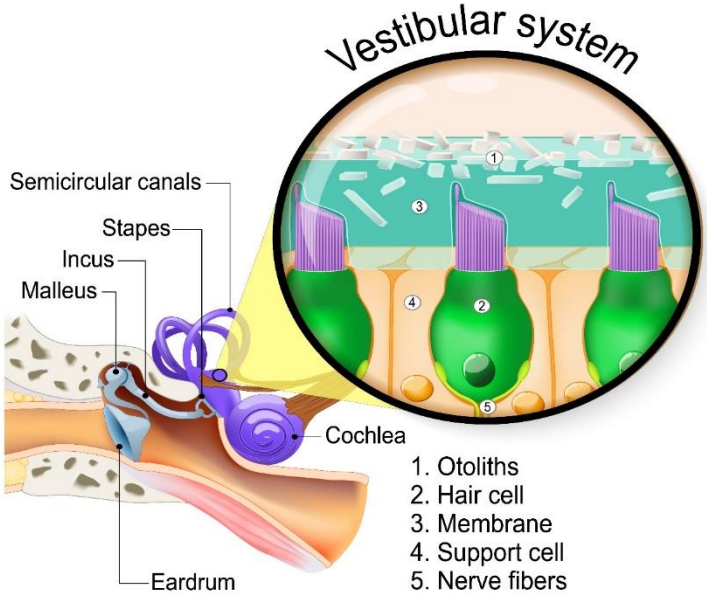


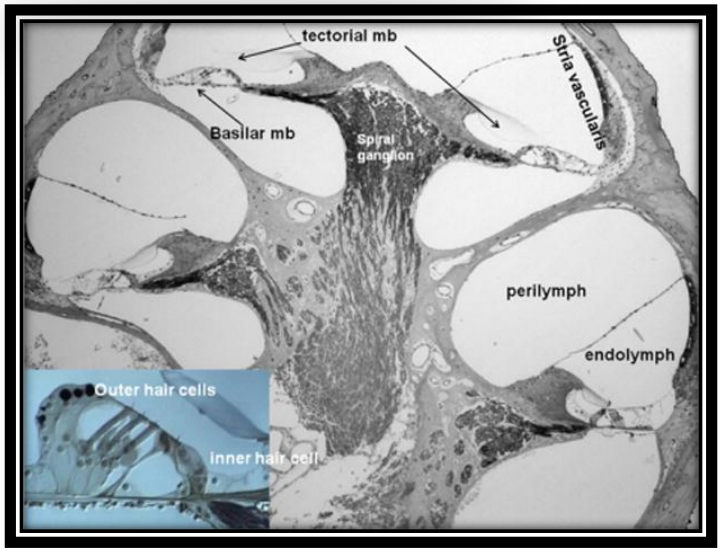
Types of Ototoxicants

Neurotoxicants



Vestibulotoxicants





Cochleotoxicants

Ototoxic Chemicals

Pharmaceuticals

- Some antibiotics
- Loop diuretics
- Analgesics
- Antipyretics

Solvents

- Toluene
- p-Xylene
- Carbon disulfide
- Styrene

Asphyxiants

- Carbon monoxide
- Hydrogen cyanide
- Tobacco smoke

Metals & Compounds

- Mercury
- Lead

Pharmaceuticals

Antibiotics	Loop Diuretics	Analgesics and Antipyretics	Antineoplastic Agent
Streptomycin	Furosemide	Aspirin	Cisplatin
Gentamycin	Ethacrynic acid	Quinine	Carboplatin
Tetracyclines		Chloroquine	Bleomycin

Tobacco Smoke

What will happen?

Eustachian tube

Blood Pressure

Neurotransmitters

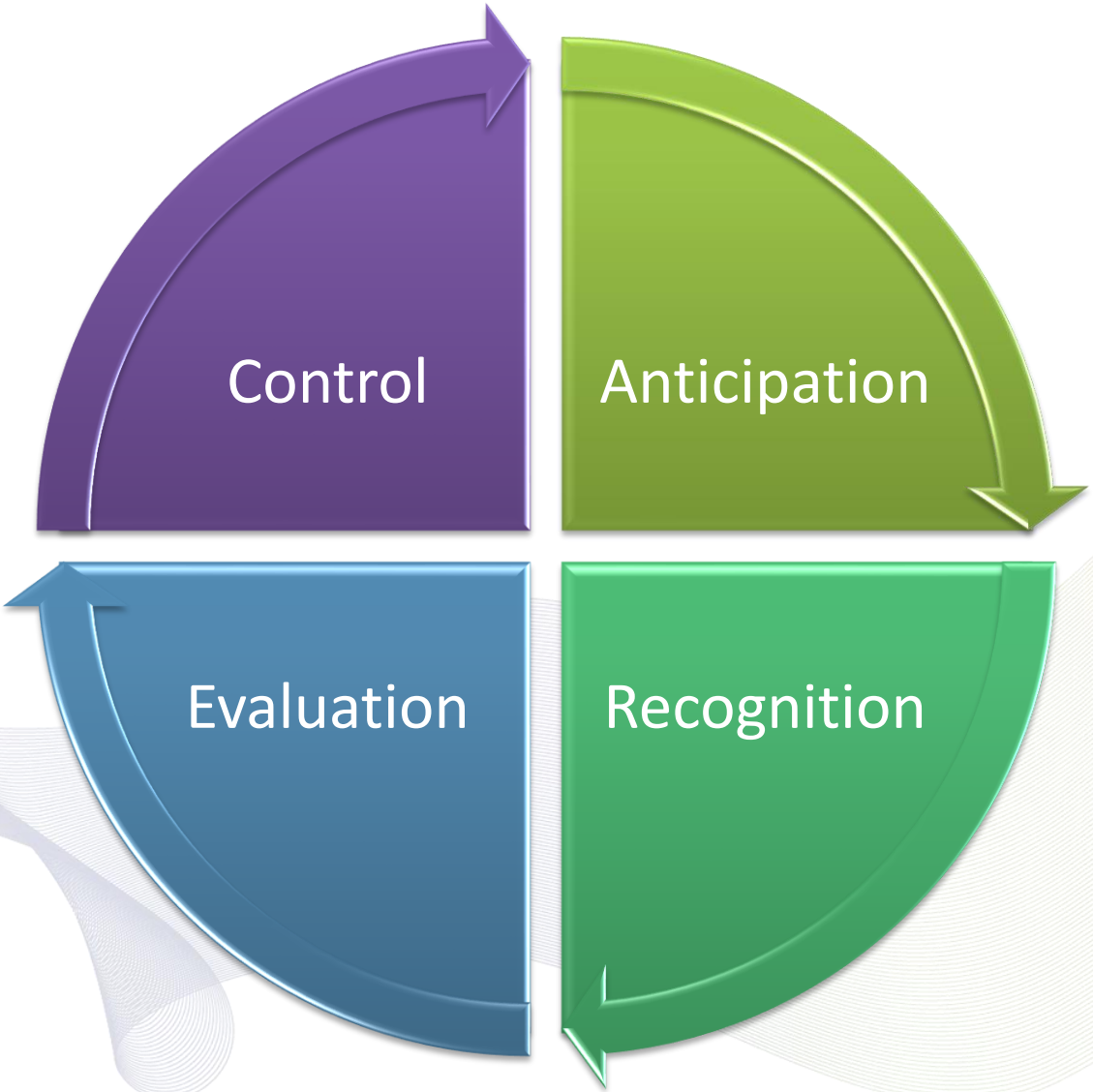
Central nervous system

E-cigarettes?

Ototoxicants in Industry

What should we do?

Industrial Hygiene



Industries with Ototoxicants

- Machinery
- Plastics
- Firefighting
- Transportation
- Petroleum
- Painting
- Construction
- Vehicles & Aircraft
- Pesticide Spraying

Anticipation

Available Information

Recognition

- Safety Data Sheets (SDS)

Section 11. Toxicological Information
Toxicological Information: Specific target organ toxicity – single exposure: Based on the concentration of this chemical in the mixture, the specific target organ toxicity – single exposure classification is a Category 1. Animal studies and human pharmacovigilance reports identify this chemical as a neurotoxicant.

- ACGIH "OTO" Notation

TLV®–CS

Substance [CAS No.] (*Documentation* date)	ADOPTED VALUES TWA	STEL	Notations	MW	TLV® Basis
Ethylamine [75-04-7] (2013)	5 ppm	15 ppm	Skin	45.08	URT irr
Ethyl amyl ketone [541-85-5] (2007)	10 ppm	—	—	128.21	Neurotoxicity
* Ethyl benzene [100-41-4] (2021)	20 ppm	—	OTO; A3; BEI	106.16	URT & eye irr; ototoxicity; kidney eff; CNS impair

Source/Copyright: ACGIH 2022 TLV/BEI Booklet

32 — Adopted Values

- Occupational vs. Non-Occupational

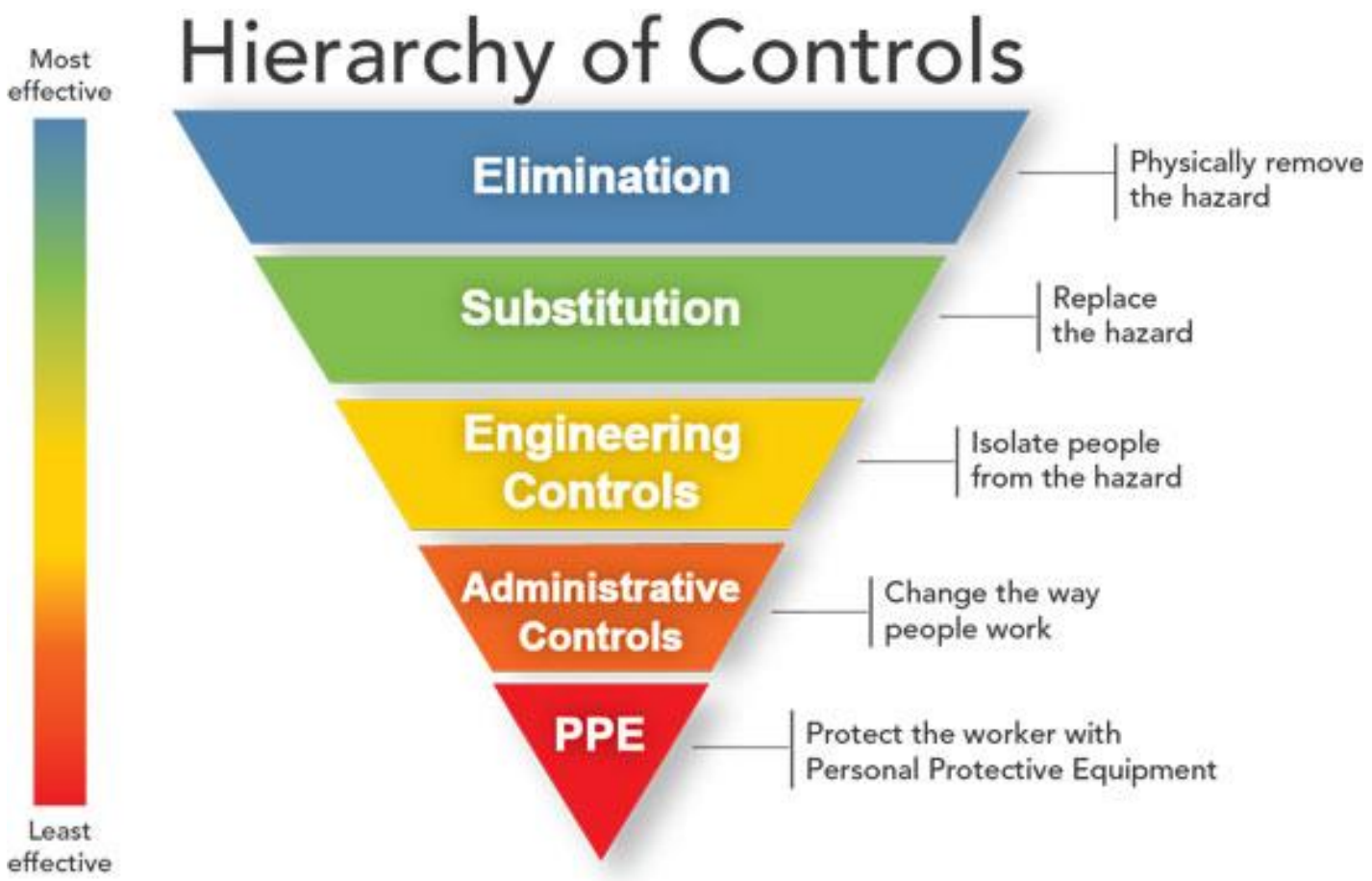
IH Monitoring

Air Sampling

Noise Surveys

Evaluation

Hierarchy of Controls



https://www.cdc.gov/niosh/topics/hierarchy/default.html

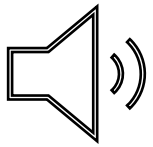
Hearing Conservation Program?

- Periodic audiograms
  - Employees exposed to 50 percent of the noise OEL
  - Employees exposed to 20% or more of the contaminant's TLVs
  - Employees where dermal exposure to an ototoxic is uncontrolled
- Employer awareness program
- Inclusion in hearing conservation or medical surveillance programs for OTO notation chemicals.

A Missing Link…

Hearing Loss

Chemical Exposure



Noise Exposure

The Future…

Additional Studies

Guidance/ Regulation

Training

References

- “Combined exposure to noise and ototoxic substances” - European Agency for Safety and Health at Work
- AIHA *The Synergist*, “Ototoxicants and Hearing Impairment”, Dec. 2019
- *Annals of Occupational and Environmental Medicine*, Article Number 22 (2018)
- DHHS (NIOSH) Publication Number 2018-124 https://www.cdc.gov/niosh/docs/2018-124/)
- https://synergist.aiha.org/201912-ototoxicants-and-hearing-impairment
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- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4693596/
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2879657/
- https://www.asha.org/public/hearing/ototoxic-medications/
- https://www.audiologyandhearing.com/blog/how-are-smoking-and-hearing-loss-related/

Thanks for your attention!!

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lalvarado@skcinc.com

¡Gracias!