



Ototoksiske forbindelser i arbeidsmiljøet

7. januar 2011

Oljeindustriens Landsforenings (OLF) fredagsseminar
("First Friday")



Halvor Erikstein

Sertifisert yrkeshygieniker /
organisasjonssekretær

Sammenslutningen av fagorganiserte i
energisektoren.

SAFE

halvor@safe.no

www.safe.no

Du er invitert på konsert hvor det spilles høyt. Noe du bør tenke på som kan forsterke risikoen for hørselsskade?
Har du ototoksiske forbindelser i kroppen som kan gjøre deg mer sårbar for en hørselsskade?



1 You're invited!
2 The Rough Riders
3 Friday March 29th
4 An eclectic stew of electro-acoustic funk, drum and hip hop.
5 An integration of rythem instruments with samplers & drums.
6 Get your tickets early!
7 Available at Ear Candy, Cactus Records, and Rockin Rudys
8 Presale \$22, \$25 at the door
9 Time: Doors open at 8 PM, Show begins at 9 PM
10 Location: The Club, located at 205 W. Main
11 For More Info: call 888.123.4567 or visit www.theclub.com

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HOW-TO's

Decibel (Loudness) Comparison Chart

Here are some interesting numbers, collected from a variety of sources, that help one to understand the volume levels of various sources and how they can affect our hearing.

Environmental Noise	
Weakest sound heard	0dB
Whisper Quiet Library	30dB
Normal conversation (3-5')	60-70dB
Telephone dial tone	80dB
City Traffic (inside car)	85dB
Train whistle at 500', Truck Traffic	90dB
Subway train at 200'	95dB
<i>Level at which sustained exposure may result in hearing loss</i>	<i>90 - 95dB</i>
Power mower at 3'	107dB
Snowmobile, Motorcycle	100dB
Power saw at 3'	110dB
Sandblasting, Loud Rock Concert	115dB
<i>Pain begins</i>	<i>125dB</i>
Pneumatic riveter at 4'	125dB
<i>Even short term exposure can cause permanent damage - Loudest recommended exposure <u>WITH</u> hearing protection</i>	<i>140dB</i>



Australske arbeidstilsynets kampanje
www.worksafe.vic.gov.au

What causes hearing loss?



Karolinska
Institutet

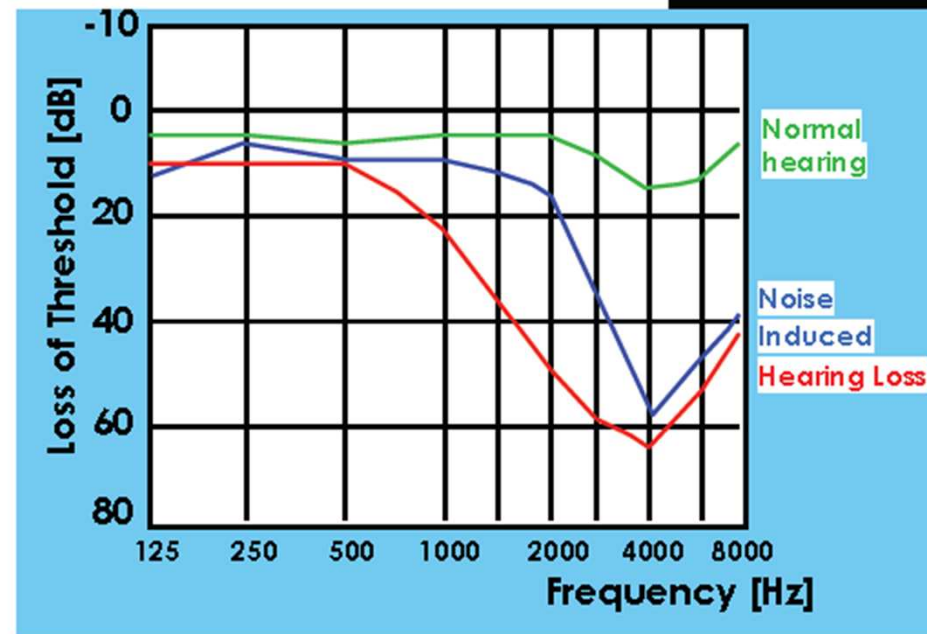
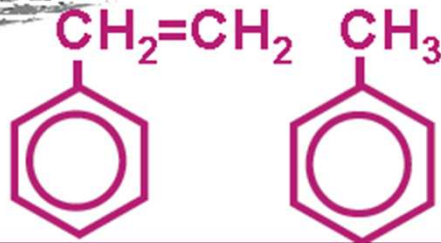
Drugs



Noise



Chemicals

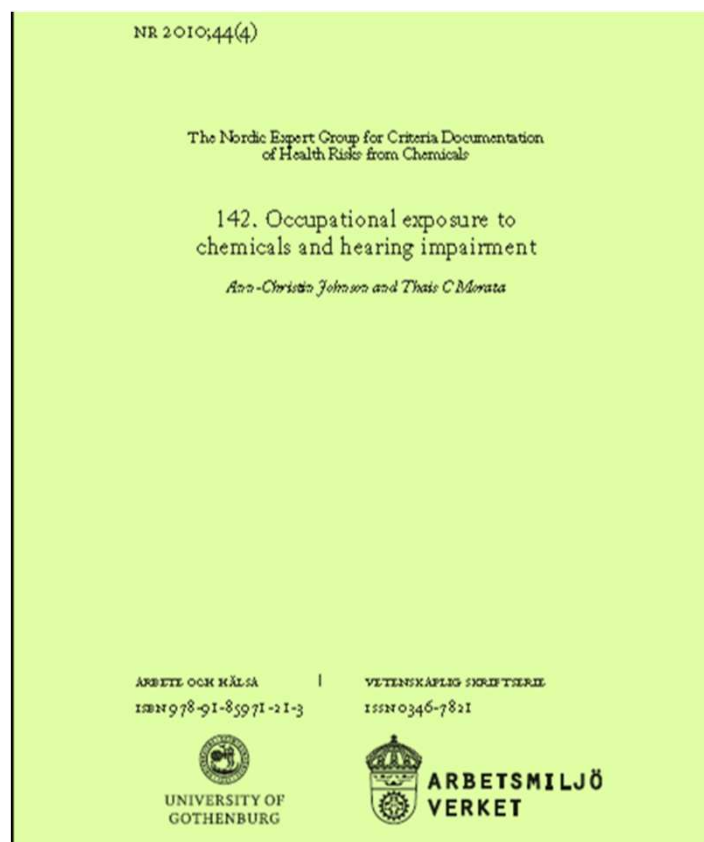


Ototoksisk forbindelse

- En forbindelse som kan forårsake funksjonell nedsettelse eller celledskade i det indre øret (hørsel og balanse), eller på VIII kranienerven vestibulo-cochlea nerven.
- Ototoks. Kan være løsningsmidler, metaller, pesticider samt ulike medikamenter.

Nordisk ekspertgruppe for kriteriedokumentasjon:
NR 2010;44(4)

142. Occupational exposure to chemicals and hearing impairment

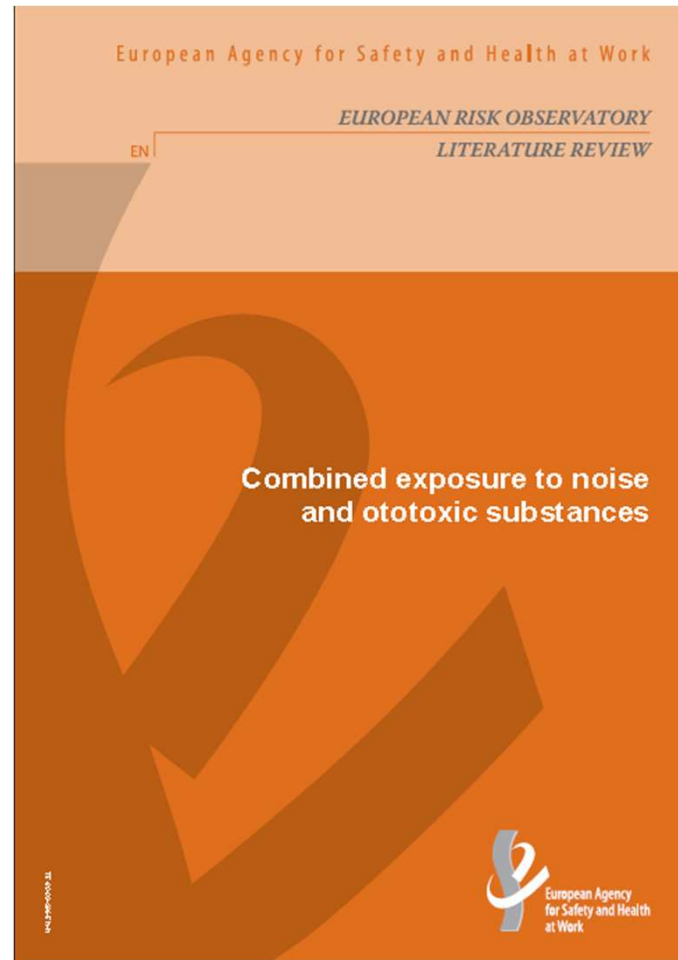


<http://www.olf.no/PageFiles/8703/Occupational%20exposure%20to%20chemicals%20and%20hearing%20impairment.pdf>

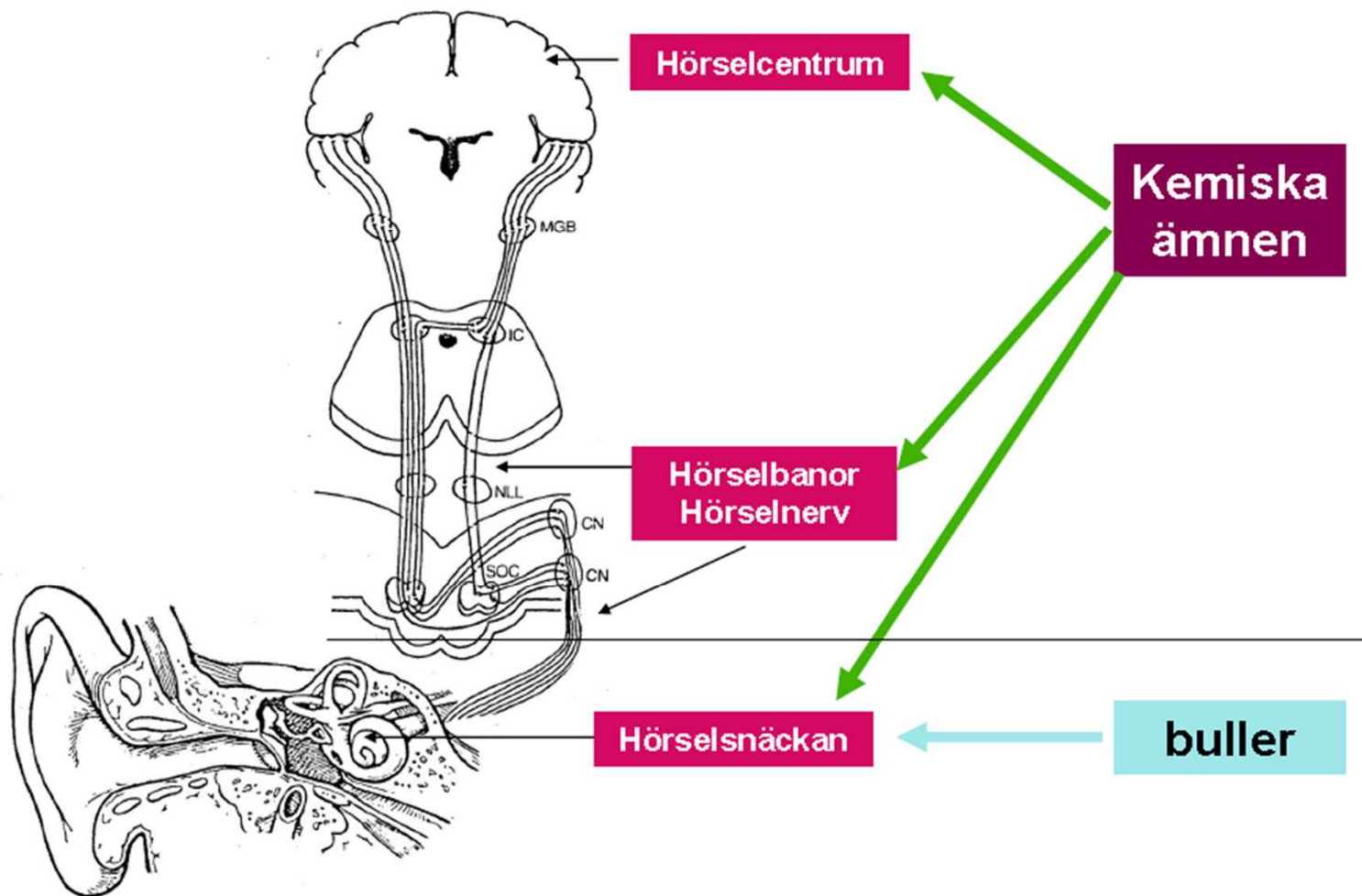
http://gupea.ub.gu.se/bitstream/2077/23240/1/gupea_2077_23240_1.pdf

EU rapport (2009)

“Combined exposure to noise and ototoxic substances”

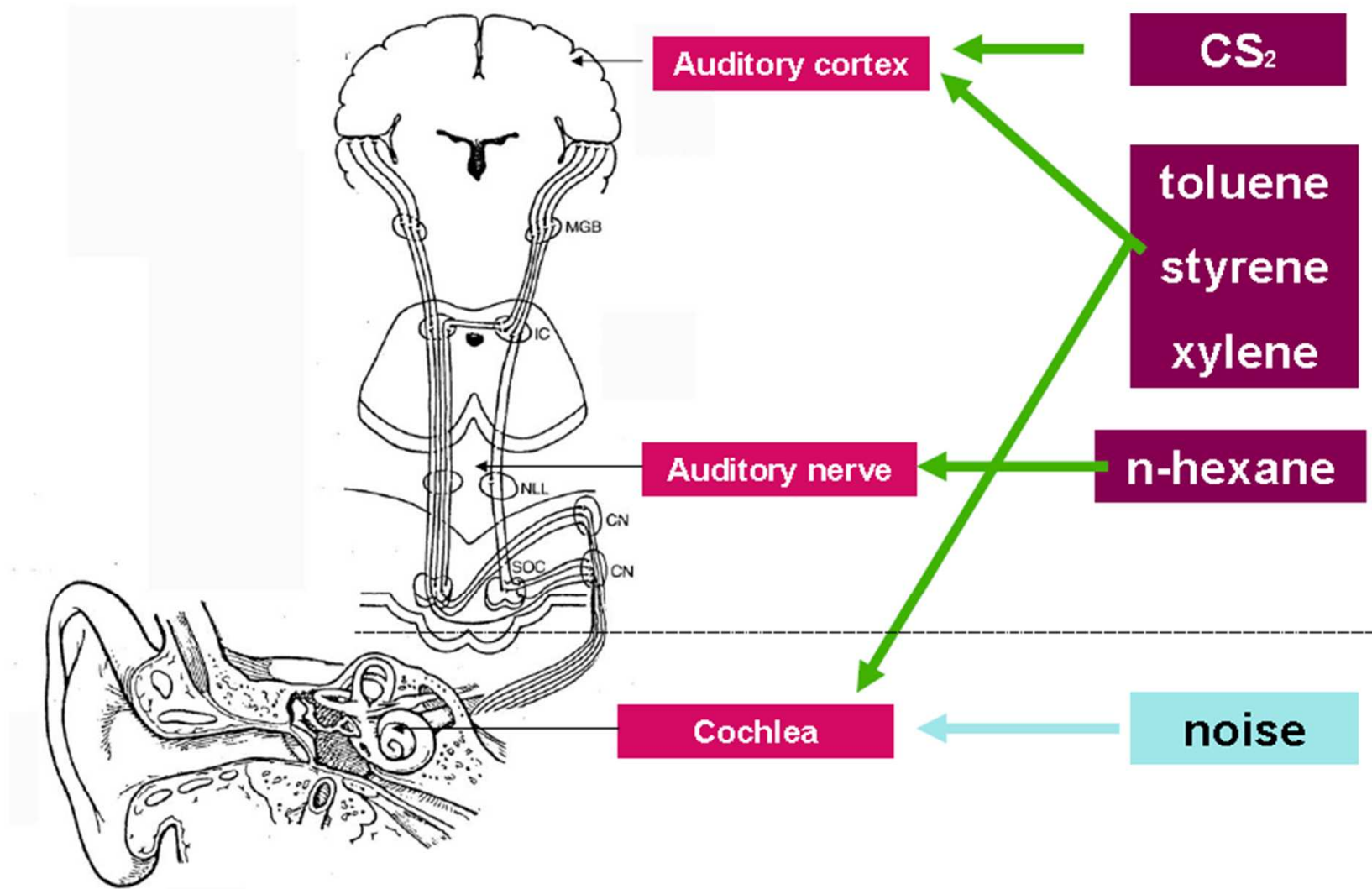


http://osha.europa.eu/en/publications/literature_reviews/combined-exposure-to-noise-and-ototoxic-substances



Kilde; Ototoxiska ämnen. Kemikalier och läkemedel som påverkar hörseln. Ann-Christin Johnson

<http://www.safe.no/doc//HMS/farlig%20frekvens/Ann%20Christin%20Johnson1.pdf>



1.5. Chemicals

- While noise is considered a **physical factor** for damage to the cochlea, chemical substances can impair the cochlea, the vestibulo-cochlear apparatus, the eighth cranial nerve or the central nervous system

EU rapport (2009)

"Combined exposure to noise and ototoxic substances

1.5.1 Neurotoxicants

- All substances which may affect the central or peripheral nervous system can be considered neurotoxic. Neurotoxic substances may be ototoxic.
- For instance, some organic solvents have adverse effects on auditory, optic and vestibular nerve fibres
- Heavy metals or compounds thereof such as mercury, trimethyltin or) can induce deafness among other symptoms.
- Carbon monoxide is believed to be neurotoxic and ototoxic because of the hypoxia induced by this gas

EU rapport (2009)

"Combined exposure to noise and ototoxic substances

1.5.3. Cochleotoxicants (sneglehuset)

- Cochleotoxicant is a chemical substance conveyed by blood up to the cochlea that impairs the cochlear structures including the auditory sensory cells (“hair cells”), the fluid-producing cell layer on the outer wall of the cochlear duct (“stria vascularis”) and the starting point of the auditory nerve, the spiral ganglion cells.
- In most cases, the cochlear hair cells are the primary targets of cochleotoxicants.
- Antitumour drugs and aminoglycosides typical cochleotoxicants.
- On the other hand, there are cochleotoxic substances that may have temporary effects. For instance, diuretics and salicylic acid can cause TTS by modifying the function of the stria vascularis.

EU rapport (2009)

”Combined exposure to nose and ototoxic substances

1.5.4. Vestibulotoxicants (indre øret)

- Vestibulotoxic substance may impair the structures and/or the function of the vestibular organ of the inner ear, thus affecting the sense of spatial orientation, body balance and movement control. Among these substances, streptomycin and gentamicin are two antibiotics well known for inducing vestibular hair cell degeneration
- In addition to antibiotics, some nitriles are known to induce vestibular dysfunction and loss of vestibular hair cells . Vestibular toxic effects may be among others dizziness, vertigo, equilibrium disorder, staggering gait or nystagmus (rapid involuntary eye movements).

EU rapport (2009)

"Combined exposure to nose and ototoxic substances

5. Combined effects

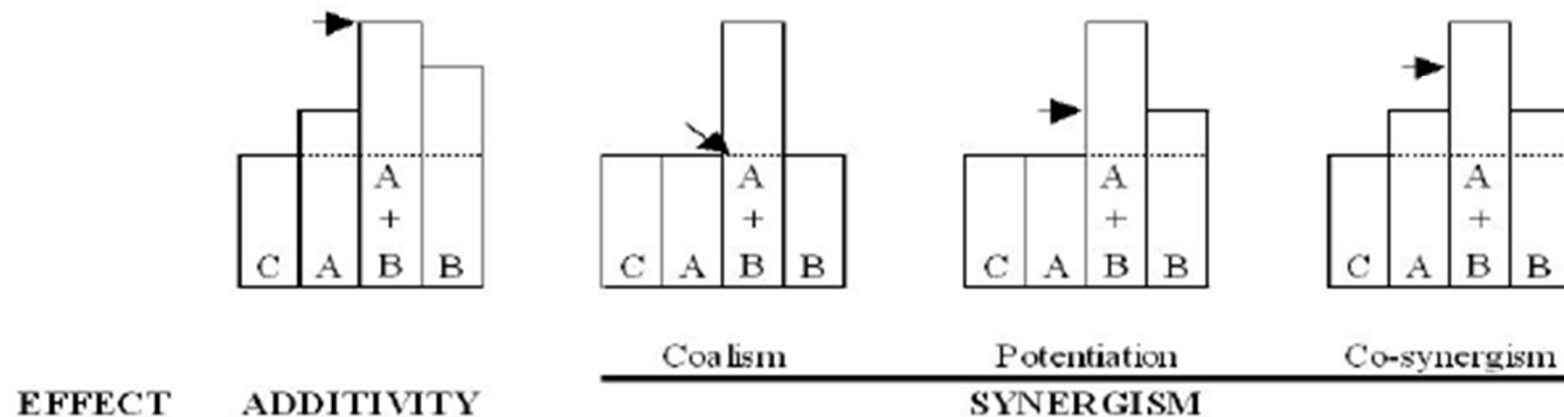
- Several work-related ototoxic substances like solvents, heavy metals, asphyxiants and certain drugs are known to be ototoxic by themselves.
- Investigations which deal with combined exposures to different ototoxic substances or simultaneous exposure to ototoxic substances and noise have shown adverse interactive effects on hearing. These interactive effects could be **additive or synergistic**.
- According to Calabrese (1991) and Greco et al. (1992), the interactive effects can be defined as:

EU rapport (2009)

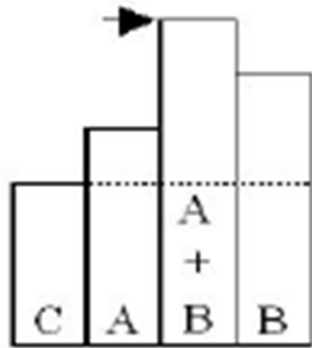
"Combined exposure to noise and ototoxic substances

Synergisme

Figure 6: Illustration of different outcomes after exposures to agents A and B. C = control (unexposed) group. Arrows indicate predicted effects. Dotted lines indicate control values (from Nylén, 1994).



Additive effect – synergistic effect

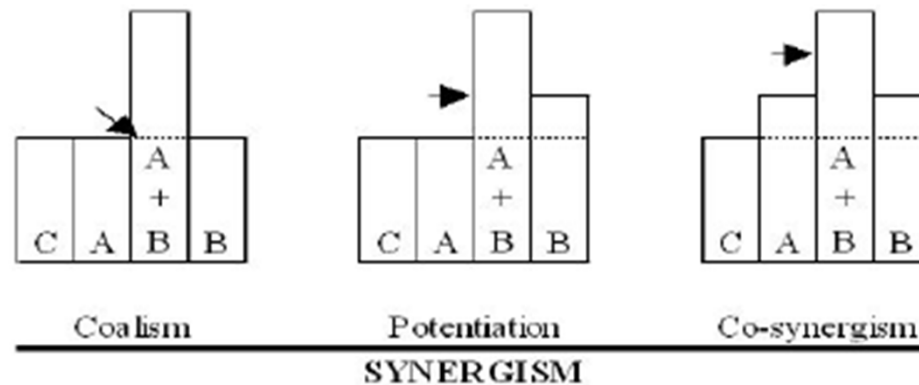


ADDITIVITY

- an additive effect, which would be the predicted sum of the effects of single exposures,
- a synergistic effect, which would have a greater amplitude than that obtained by the predicted sum of the single effects.

Synergism

- Synergism is a more complex concept, which can be subdivided in several classes:
- **Coalism**, in which none of the agents is effective individually,
- **Potentiation**, in which only one agent is effective individually.
- **Co-synergism**, in which both separate agents are effective,



EU rapport (2009)

"Combined exposure to nose and ototoxic substances

Är detta nytt? – Upptäckt av ototoxiska ämnen

Kemiskt ämne / läkemedel	Ototoxicitet upptäckt	Exempel
Tungmetaller	11th century	Kvikksilver
Läkemedel mot malaria	1843	Kinin, klorokin
Anti-inflammatoriska läkemedel	1877	salicylat (aspirin, magnecyl), ibuprofen (Ipre), indomethacin, naproxen, phenylbutazone, sulindac
Arsenik-läkemedel	early 20th century	atoxyl, salvarsan (mot syfilis)
Aminoglykosid-antibiotika	1945	streptomycin, amikacin, gentamicin, kanamycin, neomycin, netilmicin, paromomycin, tobramycin
Andra antibiotika	1960s	chloramphenicol, colistin, erythromycin, minocycline, polymyxin B, vancomycin
Vätskedrivande läkemedel	1960s	ethacrynic acid, bumetanide, furosemide (Lasix)
Lösningsmedel och andra kemikalier	1970s	toluene, organotins, carbon monoxide
Cytostatika	1970s	bleomycin, carboplatin, cisplatin, dichloro-methotrexate, nitrogen mustard, vinblastine, vincristine

Modifierad efter Schacht J, Hawkins JE. 2006 Sketches of otohistory. Part 11: Ototoxicity: drug-induced hearing loss. *Audiol Neurotol.* 2006;11(1):1-6.

Kilde; Ototoxiska ämnen. Kemikalier och läkemedel som påverkar hörseln. Ann-Christin Johnson

<http://www.safe.no/doc//HMS/farlig%20frekvens/Ann%20Christin%20Johnson1.pdf>

Ototoxiska lösningsmedel

Bensen

EJ ototoxiskt



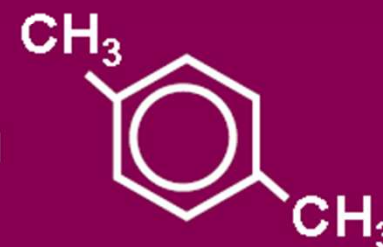
Triklloretylen



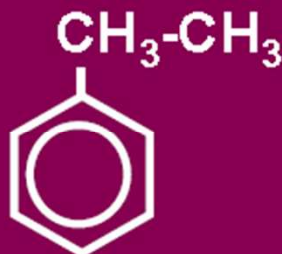
Toluen



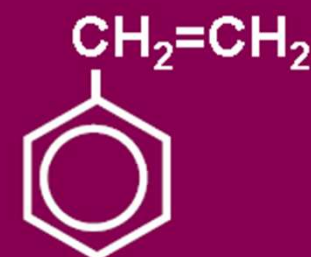
p-Xylen



Etylbenzen



Styren



n-Hexan



Koldisulfid



Blandningar

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<http://www.safe.no/doc//HMS/farlig%20frekvens/Ann%20Christin%20Johnson1.pdf>

Lösningsmedel



Djurstudier har visat:

Lösningsmedel skadar hörselsystemet
(råtta, mus, chinchilla - ej marsvin)

Skada i cochlean

Buller ej nödvändig faktor

Interaktion och potentiering tillsammans med buller
andra lösningsmedel och ASA visat



Humanstudier har visat:

Sniffning kan ge hörselskador

Yrkesexponering för toluen, styren and
lösningsmedelsblandningar kan ge hörselskador

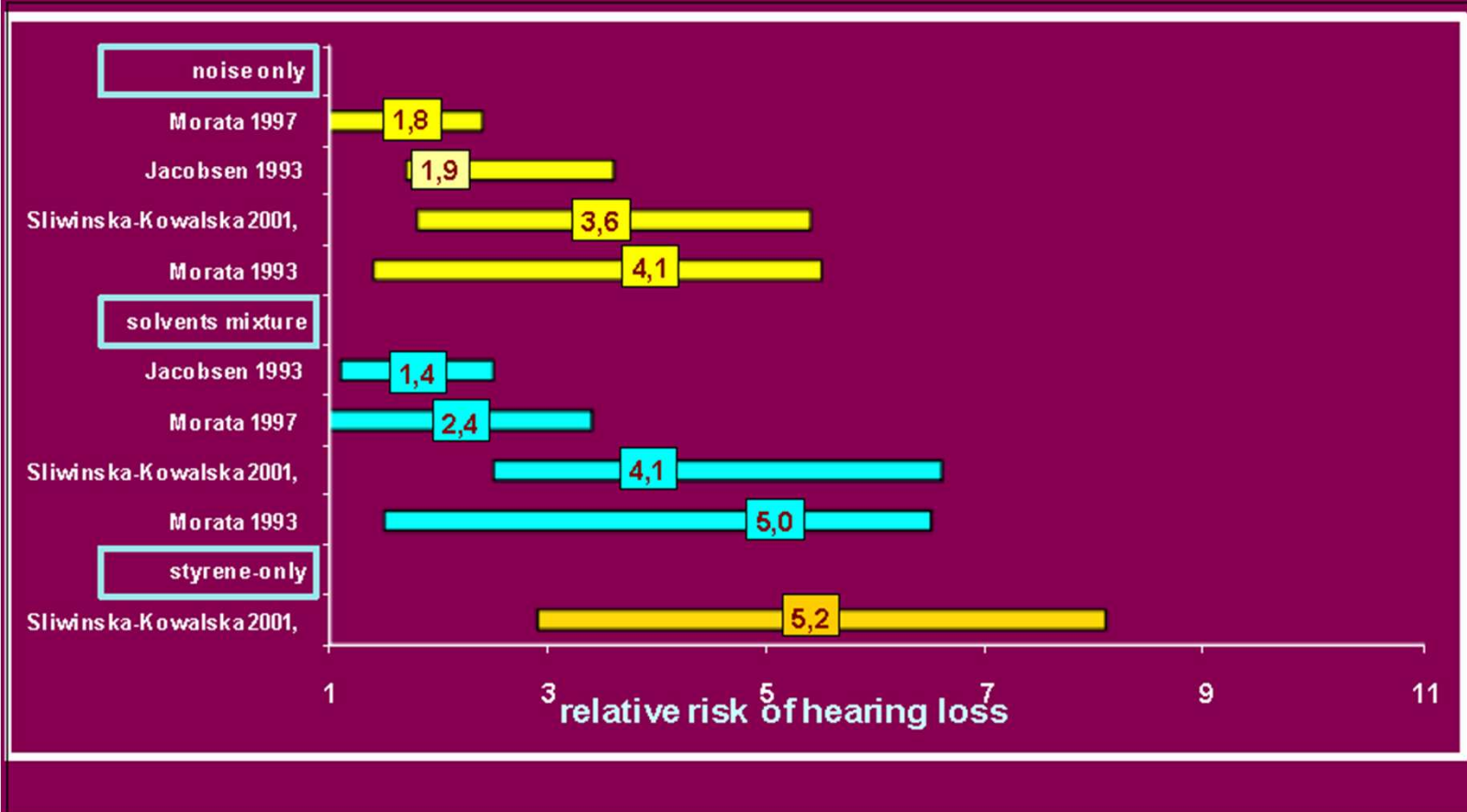
Interaktion med buller

Även vid låga bullernivåer

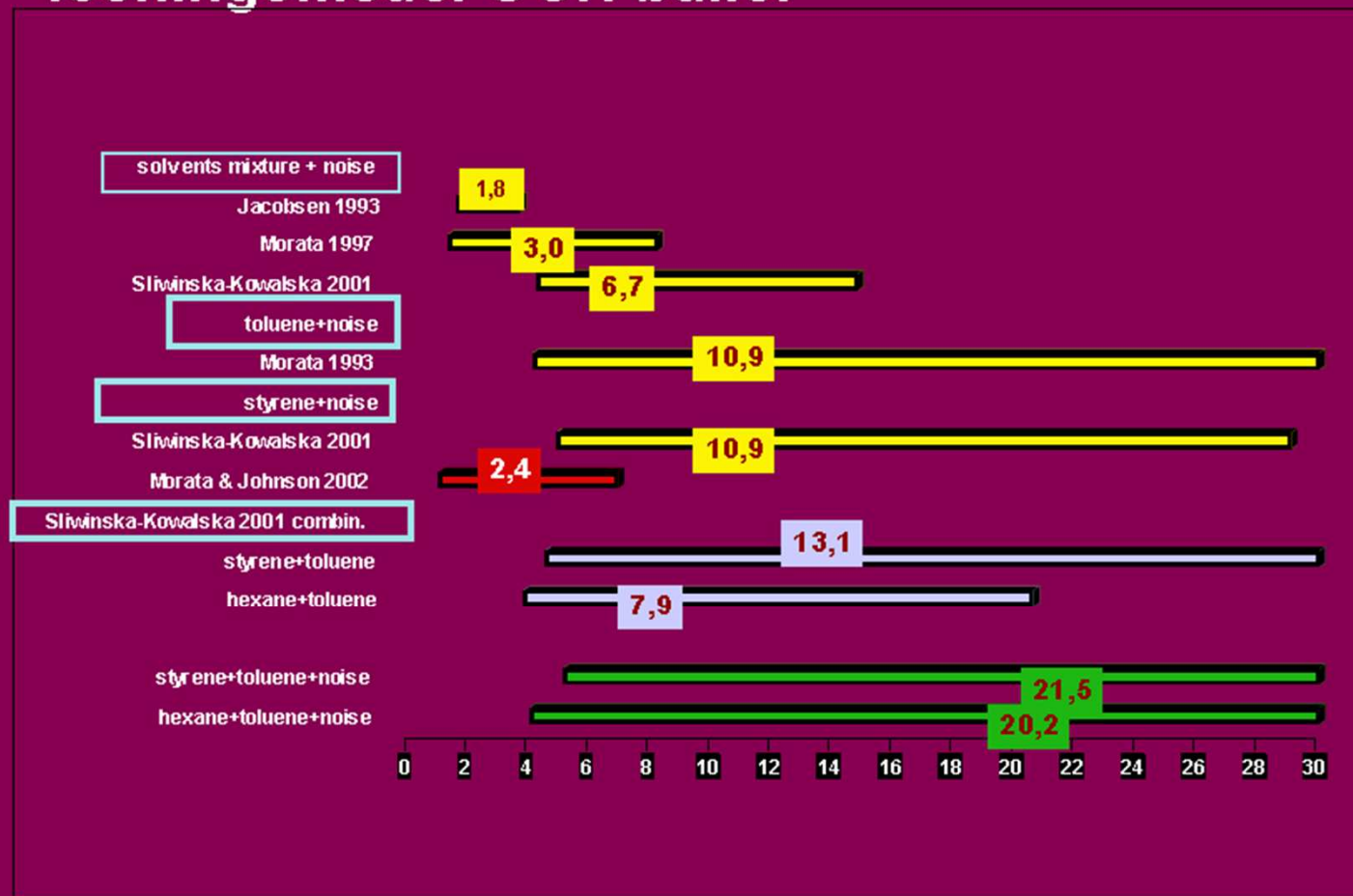
Kilde; Ototoxiska ämnen. Kemikalier och läkemedel som påverkar hörseln. Ann-Christin Johnson

<http://www.safe.no/doc//HMS/farlig%20frekvens/Ann%20Christin%20Johnson1.pdf>

Relativ riks för hörselskada - ENBART buller eller ENBART lösningsmedel



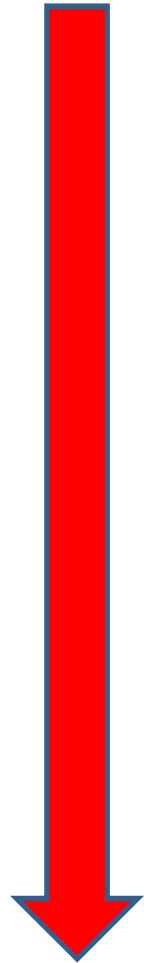
Relativ rik för hörselskada - lösningsmedel OCH buller

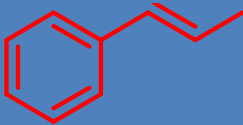
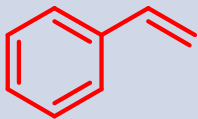
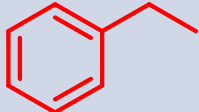
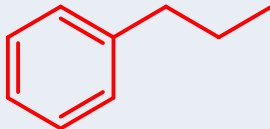
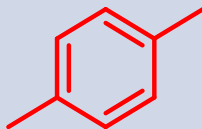
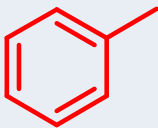
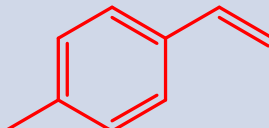


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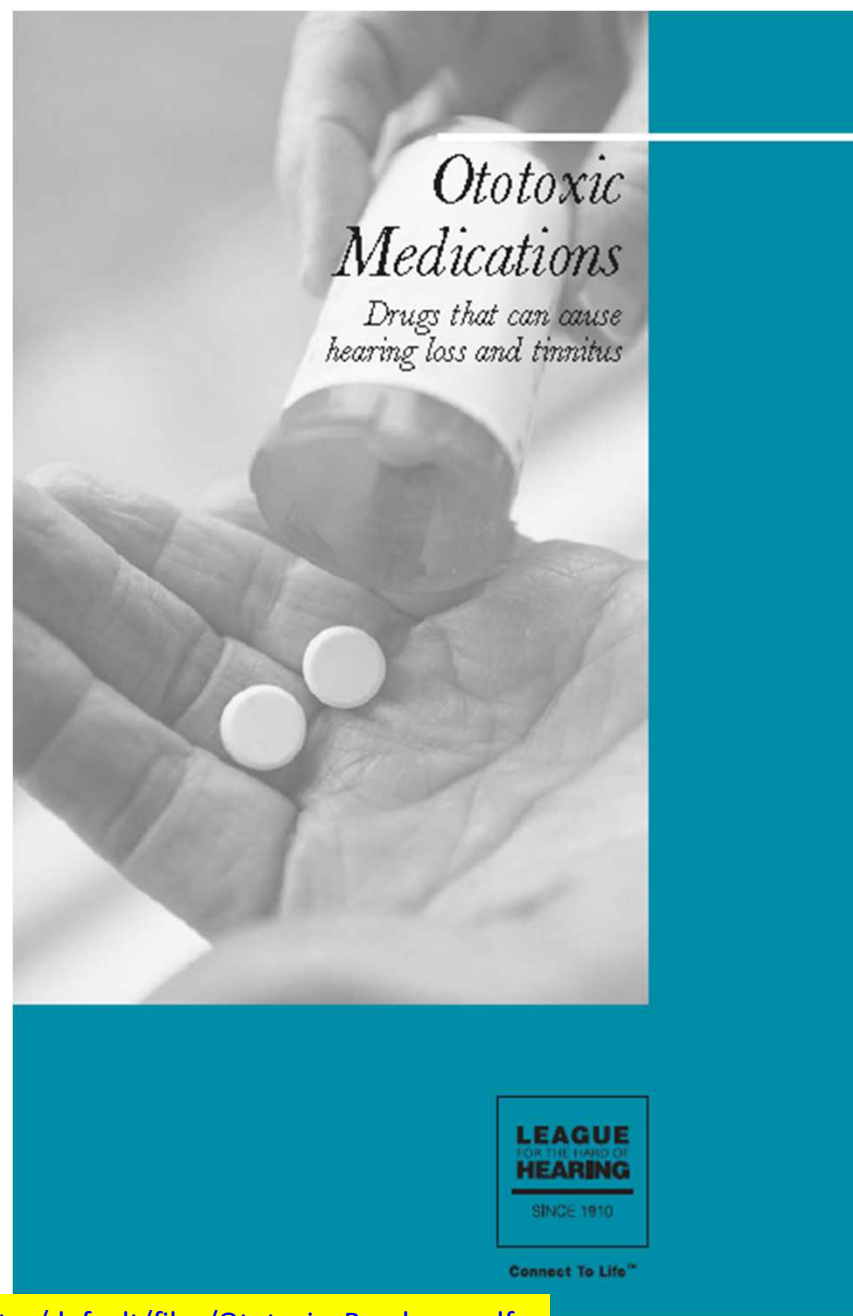
Aromaters relative ototoksisitet



Allybenzen	
Styren, Etylbenzen,	 
n-propylbenzen	
p-xylen	
Toluen	
Vinyltoluen (beta og trans metylstyren)	

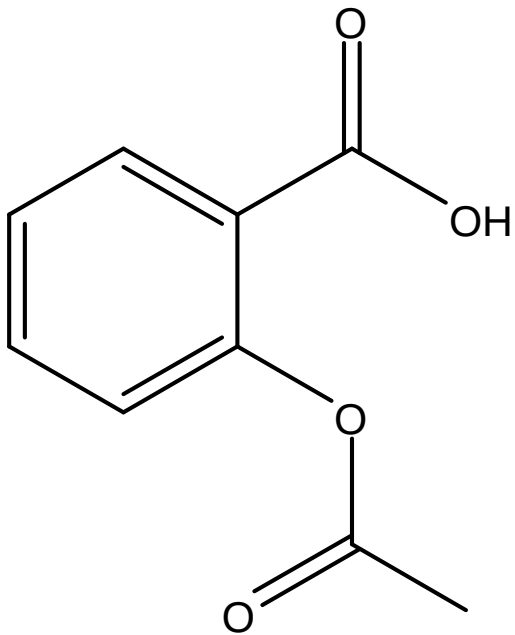


<http://centrodeacufenosbuenosaires.blogspot.com/2009/12/ototoxic-medications-drugs-that-can.html>



http://www.chchearing.org/sites/default/files/Ototoxic_Brochure.pdf

- Acetylsalisylsyre (dispril) ototoksisk



American Academy of Audiology
Position Statement and
Clinical Practice Guidelines

Ototoxicity Monitoring

October 2009

Presentasjon av NEG 144



Occupational exposure to chemicals and hearing impairment - the need for a noise notation.

Ann-Christin Johnson

PhD

Karolinska Institutet

Dept. Clinical Science, intervention and technique

Section of Audiology

Arbeidstilsynet om ototoks.

- I tillegg er visse kjemikalier ototoksiske, det vil si "giftige for øret". Risikoen for å få en støyskade er større når man arbeider i støyende omgivelser og med slike stoffer samtidig. Denne effekten er særlig observert mellom støy og løsemidler som blant annet toluen, styren og karbondisulfid.

-Fra Støy og helse

<http://www.arbeidstilsynet.no/fakta.html?tid=78245>

Arbeidstilsynets "Veiledning om hørselskontroll av støyekseponerte arbeidstakere"

- **Eksponering (nå eller tidligere)**
- kraftig støy i jobben
- annen hørselsskadelig eksponering i jobb (for eksempel organiske løsemidler, vibrasjoner)
- støy i fritiden (inkludert skyting)
- eksplosjon eller lignende
- ototoksiske medikamenter (antibiotika eller andre)
- hodeskade (for eksempel kraftig hjernerystelse)
- hørselsvern
- støyreducerende tiltak

Toxic Effects of Chemical Mixtures

- **ABSTRACT.** Exposures to chemical mixtures have reportedly produced unexpected effects. Examination of new case studies, as well as those previously reported, shows that when the of chemicals that include lipophilic and hydrophilic species, the lipophiles facilitate the absorption of the hydrophiles at enhanced levels and produce effects that are not expected from an individual chemical.
- These effects include enhanced acute and chronic responses, low-level concentration response, and unexpected target organ attack. Octanol:water partition coefficients are predictive of relative lipophilicity and hydrophilicity. The findings have implications for safe drinking water standards, air quality standards, safe industrial and environmental exposure levels, product formulation, product labeling, and protocols for toxicity testing of chemical products.

HAROLD I. ZELIGER

Zeliger Chemical, Environmental
& Toxicological Services
West Charlton, New York

Archives of Environmental Health
January 2003 [Vol. 58 (No. 1)]

CNS effekter ved lav blandingseksponering

Mutti et al. described CNS effects that resulted from exposure of shoemakers to *n-hexane*, cyclohexane, methylethyl ketone (MEK), and ethyl acetate . All 4 chemicals were present in concentrations below TLVs when measured in the workers' breathing zones.

Valentini et al. reported peripheral neurotoxicity following exposure of a shoemaker to MEK, ethyl acetate , cyclohexane *n-heptane* [4.66], and isomers of *hexane* and cyclohexane. All exposures were below the TLV.

The authors hypothesized that MEK might have potentiated the neurotoxicity of *n-heptane*, just as it does for *n-hexane*.

Both of these studies demonstrated the onset of neurotoxic effects from exposures to low-level chemical concentrations.

Lynol

3. Stoffblandingers sammensetning og stoffenes klassifisering

Stoffer er helse- eller miljøfarlige i henhold til Forskrift om klassifisering og merking m.v. av farlige kjemikalier, Vedlegg VI Stofflisten.

Kjemisk navn*	Merknader	CAS nummer	EC nummer	% etter vekt	Klassifisering
toluen	4-6	108-88-3	203-625-9	50 - 100	F; R11 Repr. Cat. 3; R63 Xn; R48/20, R65 Xi; R38 R67
n-butylacetat	6	123-86-4	204-658-1	10 - 25	R10 R66, R67
etanol	-	64-17-5	200-578-6	10 - 25	F; R11
Se avsnitt 16 for de fullstendige R-setningene det vises til ovenfor					

Synthetic jet engine oils



- MIL SPEC 23699F
- TCP: 3% - ortho meta and para isomers
- PAN: 1%
- Base stock
- Proprietary compounds.

Offshore har felles problemstillinger med luftfart: Avlufting fra smøresystem





Bilder og lenker til presentasjonene



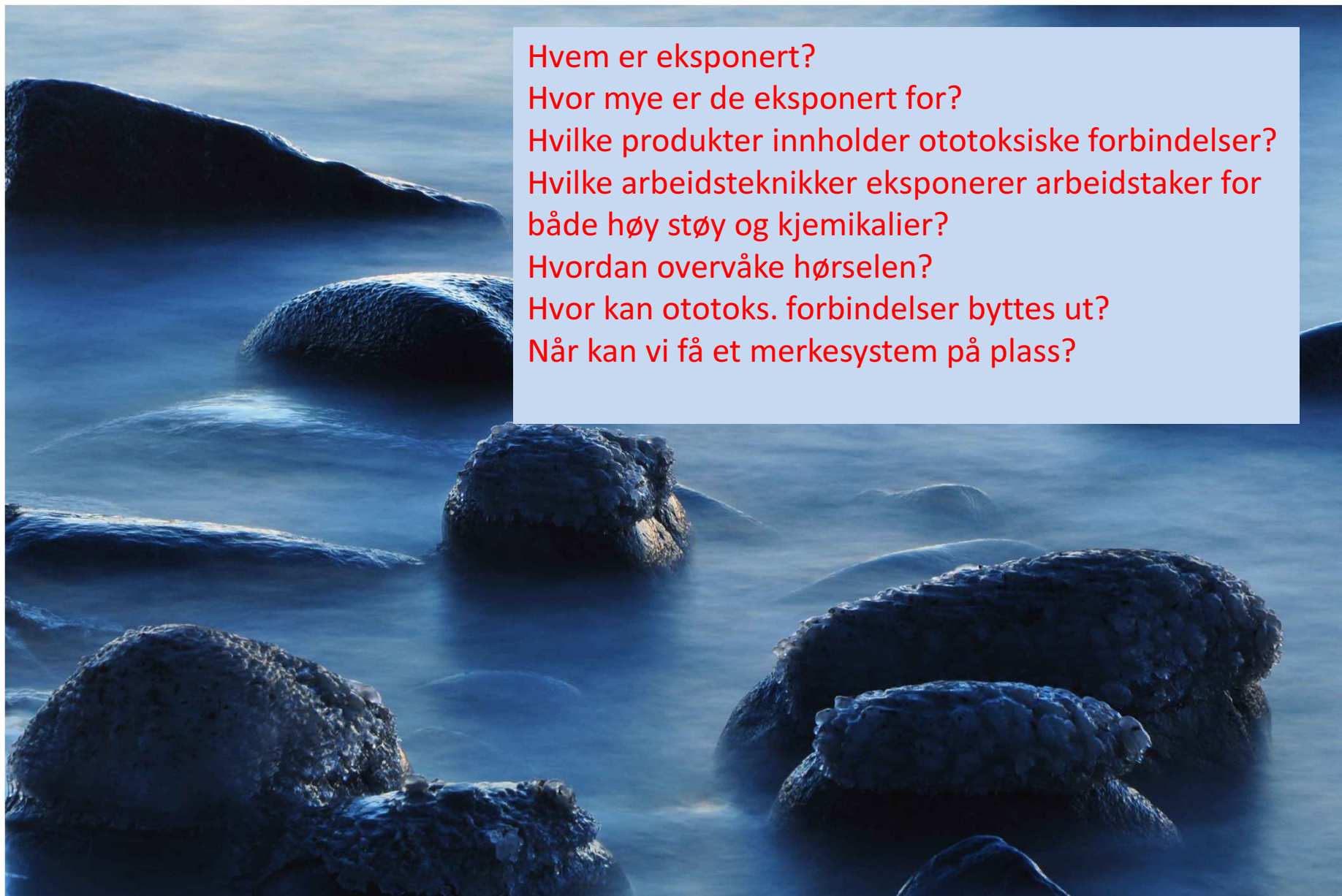
Konferansen

FARLIG FREKVENNS

Om støy og vibrasjon i arbeidsmiljøet

Sandnes, Hotel Residence 5. og 6. mai 2010

Presentasjonene kan lastes ned her; [tp://safe.no/index.cfm?id=305373](http://safe.no/index.cfm?id=305373)



Hvem er eksponert?

Hvor mye er de eksponert for?

Hvilke produkter inneholder ototoksiske forbindelser?

Hvilke arbeidsteknikker eksponerer arbeidstaker for både høy støy og kjemikalier?

Hvordan overvåke hørselen?

Hvor kan ototoks. forbindelser byttes ut?

Når kan vi få et merkesystem på plass?