



NOISE & HEARING CONSERVATION

**A TRAINING FOR THE
METALWORKING INDUSTRIES**



➤ **Updated on June 2015**



HSE Society | مجتمع السلامة والصحة والبيئة

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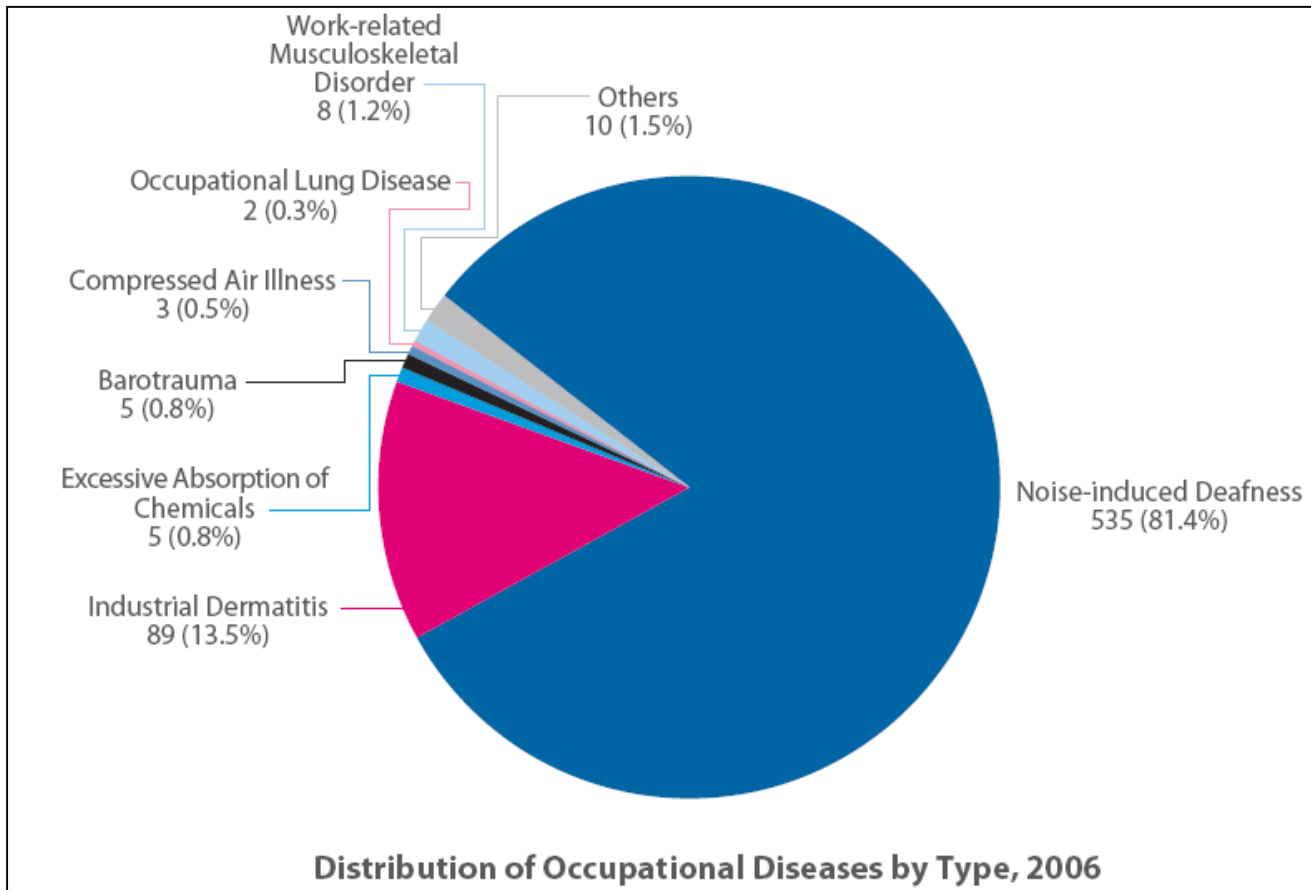
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Introduction



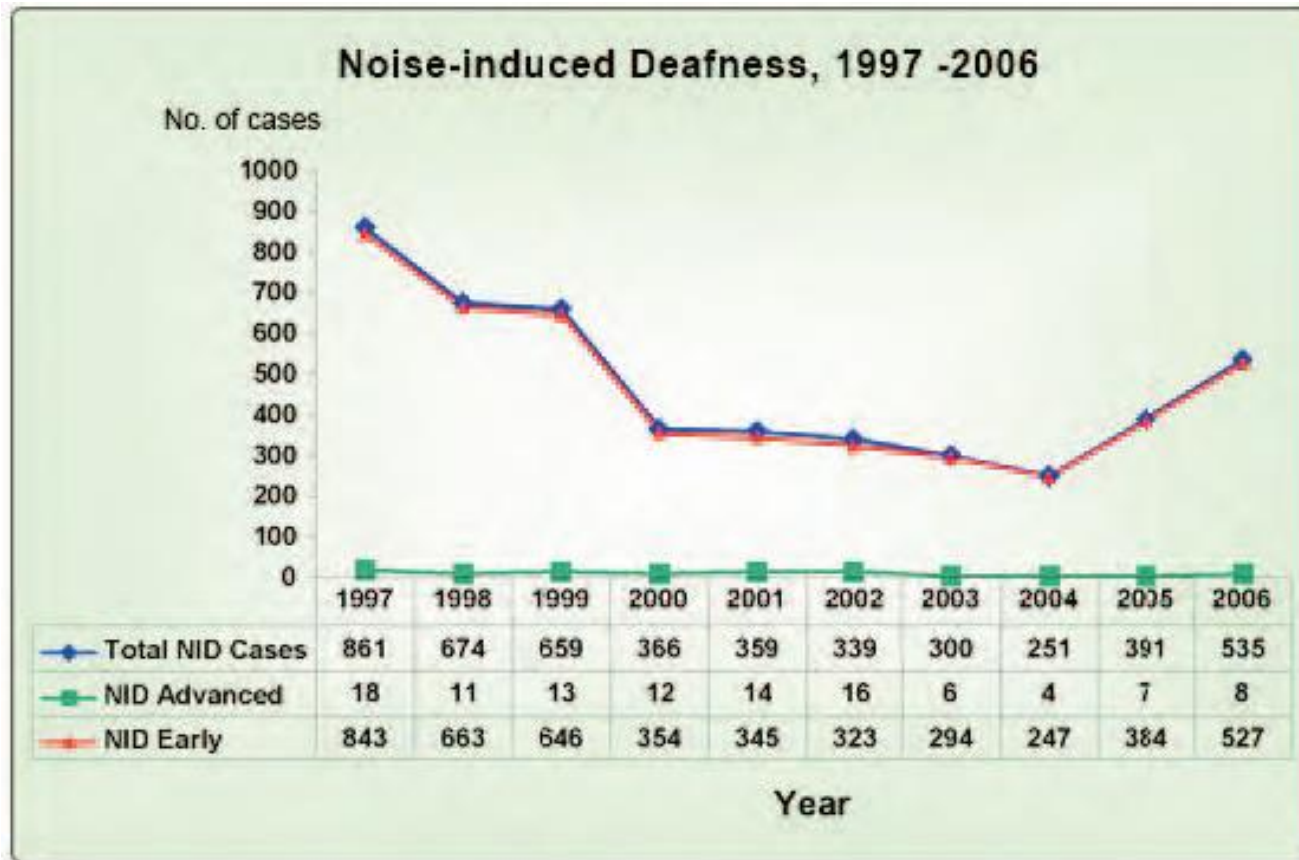
- ❑ Noise is common in metalworking industries
- ❑ Noise is a major occupational health hazard
- ❑ Exposure to excessive noise can cause **noise-induced deafness**
- ❑ Noise also interfere with communication and induce stress

Occupational Diseases in Singapore



Source: Ministry of Manpower

Occupational Diseases in Singapore



Source: Ministry of Manpower

Legal Requirements



- ❑ Required to manage risks under WSH (risk management) regulations
- ❑ Risk assessment must be conducted for all work activities, including noisy processes
- ❑ WSH (Noise) Regulations include noise monitoring, hearing protectors & training
- ❑ WSH (Medical Examinations) Regulations for annual audiometric test
- ❑ Permissible Exposure Limit for Noise - Not more than 85 dB(A) for 8 hours duration

Legal Requirements



PERMISSIBLE EXPOSURE LIMITS FOR NOISE

Sound pressure level, dB(A)	Maximum duration per day
85	8 hours
86	6 hours 21 minutes
87	5 hours 2 minutes
88	4 hours
89	3 hours 11 minutes
90	2 hours 31 minutes
91	2 hours
92	1 hour 35 minutes
93	1 hour 16 minutes
94	1 hour
95	48 minutes
96	38 minutes
97	30 minutes



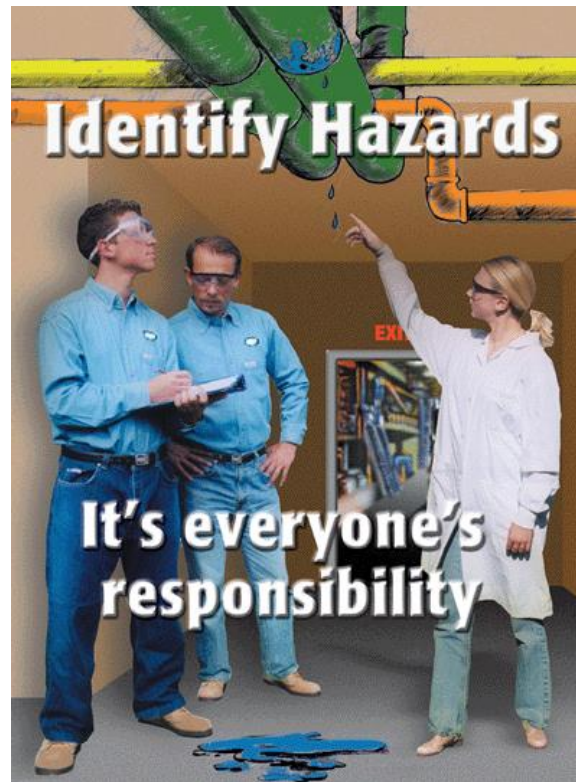
For every 3 dB(A) reduction, the time exposure is reduced by half

Risk Management on Noise

- Required to manage risks under WSH (Risk Management) regulations
- Assess the risk
- Take all reasonably practical steps
- Eliminate any risks

Risk Management on Noise

- ❑ Step 1: Identification of hazard (Noise Sources)



Picture source: <http://www.safetyworld.com/images/101.gif>

Common Noise Sources

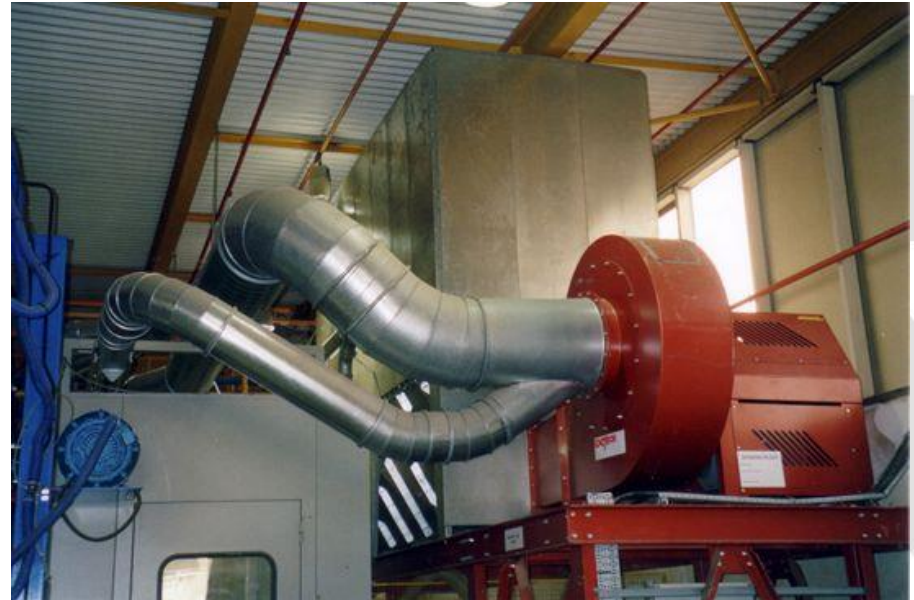
- Power press
- Waste extraction Fan
- Electric motor
- Banging and knocking of metal sheets



Picture source: <http://www.indiapowerpresses.com>

Common Noise Sources

- Cyclone
- Grinding machine
- Air Compressor
- Assembly machine
- Ultrasonic welder



Picture source: <http://www.advanced-noise-solutions.co.uk>

Common Noise Sources

- CNC machine
- Milling machine
- Guillotine (shearing machines)



Picture source: <http://www.dicandilo.com.au>

Waste extraction fan



Picture source: <http://www.janchipchase.com>

Electric motor



Picture source: <http://www.made-in-china.com>

Banging and knocking of metal sheets



Picture source: <http://www.uwplatt.edu>

Grinding machine



Picture source: <http://www.powermaster-india.com>

Air compressor



Picture source: <http://www.industrial-air-compressors.com>

Assembly machine



Picture source: <http://www.globlenet.com>

Ultrasonic welder



Picture source: <http://www.surplasmachinetool.com>

CNC machine



Picture source: <http://www.me.unlv.edu>

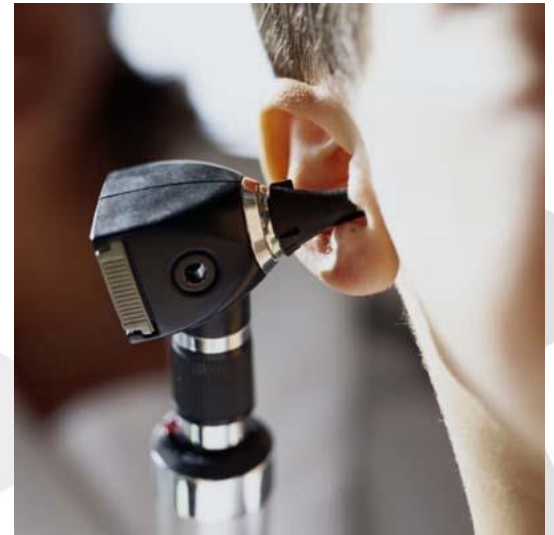
Milling machine



Picture source: <http://www.simplycnc.com>

Noise and its effect

- Loss of hearing
- Increases blood pressure
- Increases breathing rate
- Disturbs digestion
- Can cause an upset stomach or ulcer
- Sleep difficulties, even after noise stops
- Intensifies the effects of drugs and alcohol



Picture source:
<http://health.howstuffworks.com>

Noise Thermometer



Picture source:
<http://www.listentoyourbuds.org/images/thermometer-noflash.gif>

Noise Induced Hearing Loss



- Often painless
- Often unnoticed
- Gradual, but real
- Hearing loss accumulates over time
- Permanent
- Preventable



Source: <http://www.hearing-guide.com/noise-induced.html>

What are the Danger Signals?



Ask yourself

- Do you have to shout to be heard at work?
- Is your hearing dulled after work?
- Do you constantly hear ringing in your ears?
- Do you have trouble having a conversation in a crowded place?
- Does your family & friends complained that you turn up the TV or radio too loudly?



Risk Management on Workplace Noise



- ❑ Step 2: Assess the risk
 - ❖ Dependent on severity of risk and likelihood of hazards occurring
 - ❖ severity X likelihood = risk level
 - ❖ Risk Level = **Low**, **Moderate** or **High**

Risk Management on Workplace Noise



Likelihood Severity	Rare (1)	Remote (2)	Occasional (3)	Frequent (4)	Almost Certain (5)
Catastrophic (A)	Medium	Medium	High	High	High
Major (B)	Medium	Medium	Medium	High	High
Moderate (C)	Low	Medium	Medium	Medium	High
Minor (D)	Low	Medium	Medium	Medium	Medium
Negligible (E)	Low	Low	Low	Medium	Medium

Risk Management on Workplace Noise



Risk Level	Risk Acceptability	Recommended Actions
Low	Acceptable	<ul style="list-style-type: none">•No additional risk control measures may be needed.•Frequent review and monitoring of hazards are required to ensure that the risk level assigned is accurate and does not increase over time.
Medium	Tolerable	<ul style="list-style-type: none">•A careful evaluation of the hazards should be carried out to ensure that the risk level is reduced to as low as reasonably practicable (ALARP) within a defined time period.•Interim risk control measures, such as administrative controls or PPE, may be implemented while longer term measures are being established.•Management attention is required.
High	Not Acceptable	<ul style="list-style-type: none">•High Risk level must be reduced to at least Medium Risk before work starts.•There should not be any interim risk control measures. Risk control measures should not be overly dependent on PPE.•If practicable, the hazard should be eliminated before work starts.•Management review is required before work starts.

Risk Management on Workplace Noise



Level	Severity	Description
5	Catastrophic	Death, fatal diseases or multiple major injuries.
4	Major	Serious injuries or life-threatening occupational diseases (includes amputations, major fractures, multiple injuries, occupational cancers, acute poisoning, disabilities and deafness).
3	Moderate	Injury or ill-health requiring medical treatment (includes lacerations, burns, sprains, minor fractures, dermatitis and work-related upper limb disorders)
2	Minor	Injury or ill-health requiring first-aid only (includes minor cuts and bruises, irritation, ill-health with temporary discomfort)
1	Negligible	Negligible injury.

Risk Management on Workplace Noise



Level	Likelihood	Description
1	Rare	Not expected to occur but still possible.
2	Remote	Not likely to occur under normal circumstances.
3	Occasional	Possible or known to occur.
4	Frequent	Common occurrence.
5	Almost Certain	Continual or repeating experience.

Risk Management on Workplace Noise

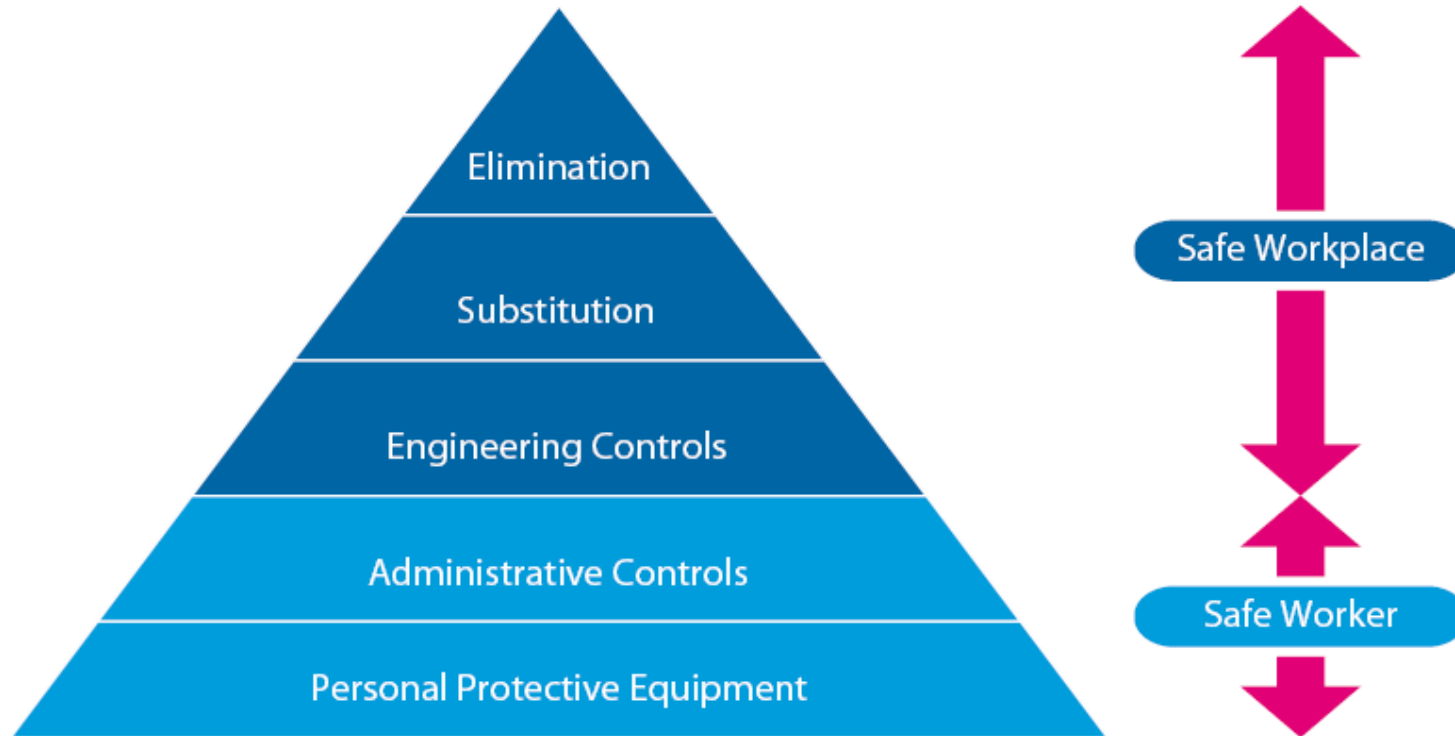


- Step 3: Select Measures to Control and Reduce Risk
 - ❖ Based on hierarchy of hazards control
 - ❖ 1st - Remove the hazard (E.g. Replace the noisy machine)
 - ❖ 2nd - Guard the remaining hazards (E.g. Erect isolation enclosure)

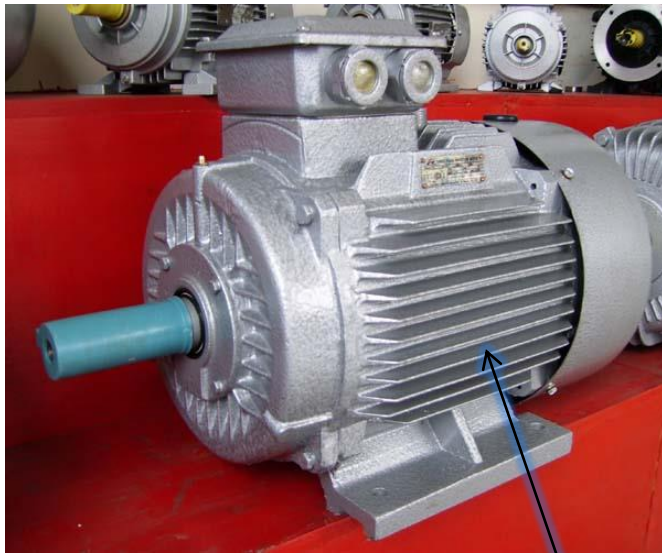
Risk Management on Workplace Noise



HIERARCHY OF HAZARDS CONTROL



1st Remove the Hazards - Replace the noisy machine with less noise machines



High noise

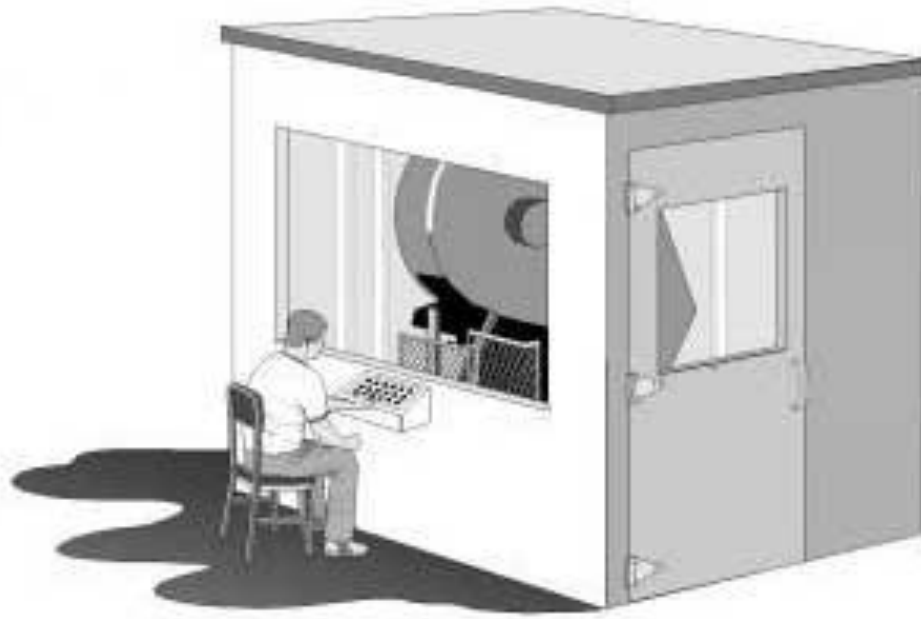
Picture source: <http://www.made-in-china.com>



Low noise

Picture source: <http://www.amer.it>

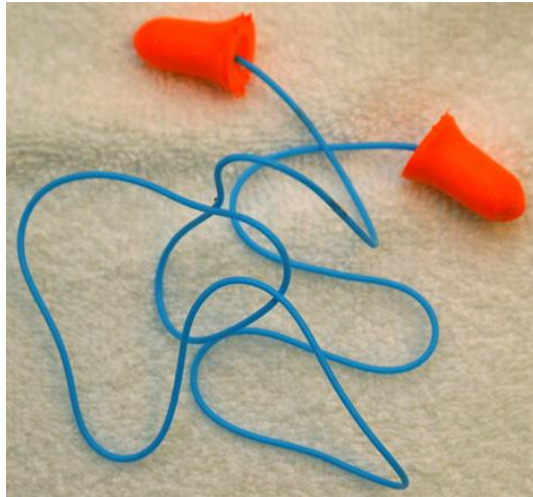
2nd Guard the remaining hazards - Erect isolation enclosure



Picture source: <http://www.cdc.gov/niosh>

Risk Management on Workplace Noise

- ❖ 3rd - Mitigate impact of hazard (E.g. Operator to wear ear plugs or muffs)



Picture source: <http://www.hometowninvasion.com>



Picture source: <http://www.sharpesafety.com>

Risk Management on Workplace Noise



- Risk assessment to be done for all noisy processes
- To identify the risk and control measures
- Establish safe work procedures (SWP)
- Inform staff of SWP
- Staff to follow SWP

Source: Ministry of Manpower

Risk Management on Workplace Noise



- Noise Control Safe Work Procedures (SWP)
 - **Noise control measures**
 - **Administrative control**
 - **Audiometric test**
 - **Hearing protectors**



Noise Control Measures

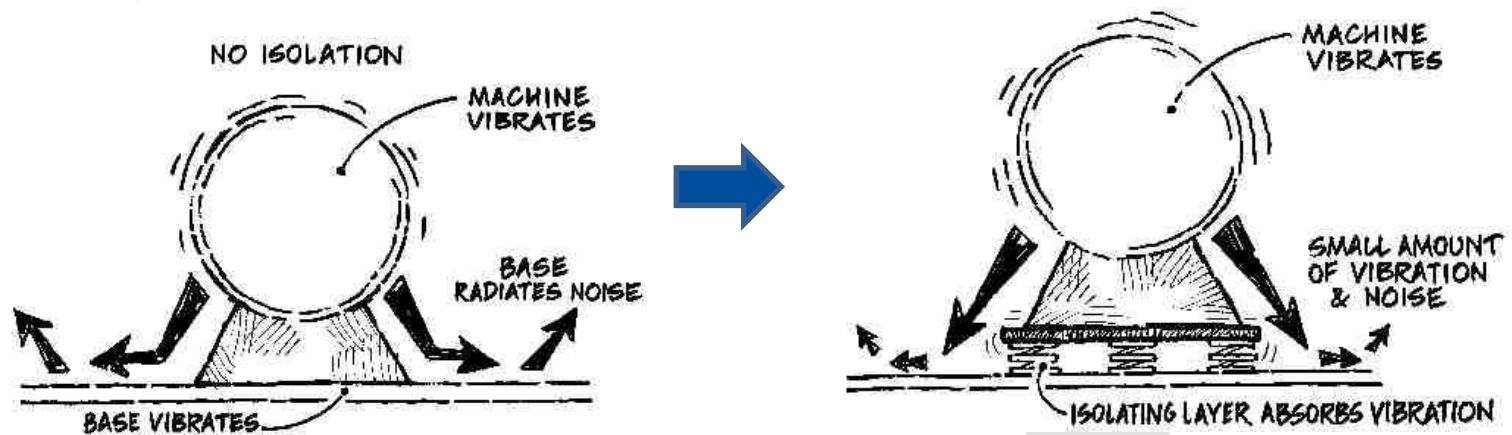
- ❖ Damping
- ❖ Silencers
- ❖ Machine enclosures
- ❖ Partition walls
- ❖ Noise barriers
- ❖ Personnel cabins

Source: CP 99: 2003

Damping

- ❖ Addition of layers of vibration-absorbing material
- ❖ Reduce vibration

VIBRATION ISOLATION



Picture source: <http://www.farmnoise.on.net/fact21.htm>

Silencers

- ❖ Devices designed to remove air-borne sound waves
- ❖ Used in pumps, compressors



Pumps equipped with silencers

Picture source: <http://www.noiseandpulsation.co.uk/silencersReactive.html>

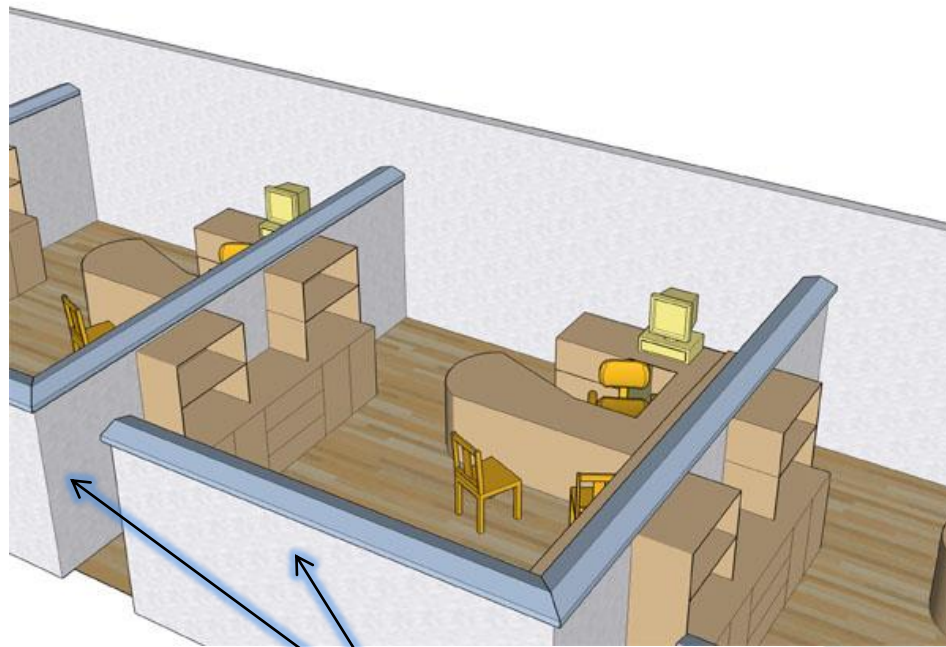
Machines Enclosure

- ❖ A structure enveloping a noise source
- ❖ Design to protect workers from noisy machines



The noise generating stamping machine (left photo) was completely enclosed (right photo) to reduce the noise level. The noise level was reduced from 95 dBA to 78 dBA.

Partition Walls



Partition walls

Picture source: http://www.acousticssciences.com/Isa/Images_Isa/cubicle3.jpg

Noise Barriers

- ❖ Consist of sheets of wood, plastics, aluminum or steel
- ❖ Reduce noise from reaching the staff/worker



Noise barriers

Picture source: <http://www.soundseal.com/barricade/barricade-index.shtml>

Personnel Cabins



- ❖ Used when noisy machines cannot be enclosed
- ❖ Enclosure specially design to shield workers from noise



Picture source: <http://ies2000atlanta.com/index.2.jpg>

Administrative Control



- ❖ Job rotation of workers
- ❖ Adding periods of quiet hours to the work day
- ❖ Scheduling noisy work when few people is around
- ❖ Notifying people in advance when noisy work is carried out
- ❖ Posting warning signs of noisy areas

Source: National Institute of Occupational Health & Safety & The State of Queensland - Department of Employment & Industrial relations

Why Conduct Audiometric Test?



- ❖ For the early detection of hearing loss
- ❖ To make sure the hearing protectors are effective
- ❖ To use the results to improve the hearing conservation programme at workplace
- ❖ To ensure workers are working in a healthy workplace



Hearing Protectors

- Types
 - ❖ Ear-muffs
 - ❖ Ear-plugs
 - ❖ Banded ear-plugs
 - ❖ Special types
(e.g. communication ear-muffs)



Picture source:
<http://cn1.kaboodle.com/>



Picture source:
<http://www.healthandsafety-supplies.co.uk>



Picture source: <http://www.letargets.com>



Picture source:
<http://www.sharpesafety.com>

Hearing Protectors

- Selection
 - ❖ Noise reduction rating
 - ❖ Wearer's comfort
 - ❖ Working environment & activity
 - ❖ Skin disorder or ear problem
 - ❖ Compatible with helmets, spectacles
- Proper Usage
 - ❖ Period of use
 - ❖ Correct fitting
 - ❖ Guidance/Training of use & maintenance
 - ❖ Care and maintenance
 - ❖ Inspection and replacement
 - ❖ Supervision of proper usage



Hearing Protectors



- Advantages of common types of hearing protectors
 - Simple to use
 - Cheap
 - Disposable
 - Mass produced and readily available

Hearing Protectors



- **Disadvantages** of common types of hearing protectors
 - ❑ Easily damaged
 - ❑ Not individually molded to fit the ear
 - ❑ May not be comfortable

Hearing Protectors



- **Care and Maintenance**

- ❖ Clean hands when handling hearing protectors
- ❖ Reusable ear-plugs to be thoroughly washed or cleaned
- ❖ Ear-muffs cushions to be cleaned following manufacturer's instructions
- ❖ Should not be shared
- ❖ Store in suitable environment
- ❖ Frequent inspection to identify damaged or deformation

Hearing Protectors

- Fitting

- ❖ Ear-muffs



- ✓ Oval-shaped muffs to be worn so that oval is vertical
- ✓ Hair should be brushed away from ear
- ✓ Muffs should cover the ears fully
- ✓ Muffs fit on the head snugly

Hearing Protectors



- Proper use

- ❖ **Ear-plugs**

- ✓ Should be the right size for each ear
- ✓ Ears should be pulled outwards and upwards before insertion
- ✓ Soft foam plugs should be rolled firmly into a thin cylinder
- ✓ Plugs may need repositioning when they become loose
- ✓ Cover ears after insertion to check if plug is properly sealed



Picture source: <http://www.ohsonline.com/articles/50683/>

Hearing Protectors

- How to wear ear plugs










Practical Exercise

Proper Use of Hearing Protectors

1. Describe how to wear ear-plugs and wear muffs
2. Describe how to care and maintain hearing protectors

Summary of Key Points



-  Legal requirements on workplace noise
-  Risk management on workplace noise
-  Common noise sources
-  Noise and its effect on hearing
-  Noise control measures
-  Audiometric test
-  Hearing protectors



Noise Induced Deafness is preventable

**Be proactive: it is up to US to
prevent it**

Thank You

References:



1. MOM Occupational Safety and Health Division Annual Report 2006
2. CP 99: 2003 Code of Practice for Industrial Noise Control
3. Ministry of Manpower - Guidelines for Industrial Noise & Vibration Control 1999 Edition
4. Guidelines on Noise Labelling
5. ProBE - Technical Advisory for Metal Industry
6. WSHAC Technical Advisory for Work in Noisy Environment - Hearing Conservation Programme
7. CP 76: 1999 Code of Practice for Selection, Use, Care and Maintenance of Hearing Protectors
8. National Institute of Occupational Health & Safety
9. The State of Queensland - Department of Employment & Industrial Relations