PHYSICAL HAZARDS

Noise exposure risks

Table of contents

1. INTRODUCTION 2
1.1. Background 2
1.2. Legal obligations 2

2. RISK PROFILE 2
2.1. Overview 2
2.2. Health effects 3
2.3. Aggravating factors and special cases 4
2.4. Legislation and best practices 5

3. SECTORS OF ACTIVITY MOST EXPOSED TO NOISE 5

4. PREVENTION APPROACH 6
4.1. Identify and analyze risks 6
4.2. Correct risks 9
4.3. Control risks 11

5. GENERAL AND SPECIFIC FIRST AID 12

6. MEDICAL SUPERVISION 12

7. SERVICES OFFERED BY RSPSAT TEAMS 12

8. SERVICES OFFERED BY OTHER PARTNERS 13

9. FOR MORE INFORMATION 14
9.1. Additional information for workplaces 14
9.2. Additional information for specialists 15

1. INTRODUCTION

1.1. Background

Workers may be exposed to noise in the workplace. This exposure can damage their health and safety, and in particular lead to permanent hearing loss. Actions can be taken to prevent or limit the effects of noise.

1.2. Legal obligations

This occupational health program is developed in accordance with section 107 of the *Act respecting occupational health and safety* (AOHS). The employer is required to take it into account in its prevention program (AOHS, s. 59) or in its action plan (AOHS, s. 61.2). This program contains recommendations for the prevention of health problems linked to noise exposure. In particular, it sets out the preventive measures to be implemented to protect the health of exposed workers. Thus, the employer must determine which actions of the occupational health program to consider and include in its prevention program or action plan to deal with noisy situations in their establishment.

Section 61 of the AOHS provides that the Commission may order an employer to submit a prevention program. It may also order the employer to amend the content of the program, in particular to bring it into line with the elements of the occupational health programs the Commission develops. Subsection 127(1) of the AOHS provides that the public health director may evaluate the health-related components of a prevention program or action plan and make recommendations to the employer, the Commission and, where applicable, the health and safety committee.

The information presented in this health program provides general guidelines. It is strongly recommended to consult the tools presented in the section For more information for the preventive actions to be implemented in workplaces.

2. RISK PROFILE

2.1. Overview

Noise is an unwanted, aggressive or annoying sound. Exposure to excessive noise levels can be detrimental to workers' health and safety.

Permanent hearing loss is the main consequence of such noise exposure. Between 1997 and 2022, the CNESST accepted nearly 145,000 cases of occupational deafness. In 2020–2021, a vast survey estimated that nearly 9% of Quebec workers were exposed to noise levels of at least 85 dBA[1] in their workplace.

Considering all the impacts for society (e.g. compensation, medical and administrative costs, loss of quality of life), the costs of occupational deafness amounted to just over $2 billion for 2017 alone.

2.2. Health effects

The effects of noise on health depend mainly on the intensity of the sound (measured in decibels or dB) and the duration of exposure.

2.2.1. Effects of chronic exposure on hearing

Chronic exposure to noise levels above 75 dBA for 8 hours can cause permanent hearing loss. Hearing loss most often affects both ears. However, for certain jobs (e.g. truck drivers, farmers) or particular noisy tasks (e.g. hand tools), one ear may be more affected.

Initially, exposure may cause a temporary drop in hearing, accompanied by tinnitus.[2] This is "auditory fatigue" caused by reversible damage to the cells of the inner ear. An "auditory rest" of at least 12 hours is necessary for the ear to recover. However, repeated exposure to noise over long work hours does not always ensure sufficient rest. The cells of the inner ear are then gradually and permanently destroyed. Deafness develops gradually, insidiously and irreversibly. It can develop after only a few years' exposure to noise. Hearing difficulties impact the quality of life of people affected. Individuals may isolate themselves because of communication difficulties, with serious consequences for family life, social life, professional life and psychological health. In the long term, deafness is also a major cause of cognitive decline and increases the risk of dementia.

Unfortunately, occupational deafness cannot be cured. Hearing aids only amplify sounds without restoring—most of the time—the quality of normal hearing. However, screening for hearing loss can help prevent hearing loss from worsening and progressing to more severe disability. To achieve this, exposure to noise in the workplace must be reduced and controlled.

[1] Decibel (dB), A-weighted decibel (dBA) and C-weighted decibel (dBC) are units of measurement used to assess sound intensity.

[2] Tinnitus is a whistling, ringing or buzzing heard in the ears or head in the absence of any external stimulus. It sometimes accompanies hearing loss. It may also be present without measurable hearing loss. It can have a variety of effects: difficulty falling asleep, limited social life and psychological problems (e.g. anxiety).

2.2.2. Effects of acute exposure on hearing

A single exposure to a very loud noise of very short duration (e.g. explosion, gunshot, pile driving, compressed air jet) can have immediate effects, such as sudden hearing loss, eardrum tearing and ear pain. These are traumas or acoustic shocks. This type of problem requires prompt medical attention to limit the severity of the effects (see section 5).

2.2.3. Effects on safety

At and above 80 dBA, noise increases the risk of industrial accidents. It can mask danger signals and audible warnings, disrupt verbal communication and reduce workers' attention. For these reasons, noise is a major cause of fatal accidents.

2.2.4. Other effects of noise

Noise causes stress, which can lead to fatigue, irritability and reduced attention, concentration and performance. The risk of cardiovascular disease, such as high blood pressure, heart attack and angina (chest pain), may be increased in workers exposed to noise.

Noise can pose a risk to the fetus (small for gestational age), as well as being potentially associated with gestational hypertension and a risk of preterm delivery. For some professions, noise exposure may lead to recommendations under the For a Safe Maternity Experience (FSME) program.

2.3. Aggravating factors and special cases

In the course of their duties, workers may be exposed to chemical substances that are toxic to the auditory system. These are usually solvents such as toluene, trichloroethylene and styrene, as well as certain metals like lead and its compounds. These substances are known as ototoxic. Organizations such as the Institut national de santé publique du Québec (INSPQ) report a longer list of chemical substances with an effect on the auditory system (e.g. ethylbenzene, mercury, xylene). Carbon monoxide aggravates the effects caused by noise.

Exposure to vibrations transmitted to the hands and arms (e.g. pneumatic air tools) increases the effects of noise on hearing. Personal factors can also aggravate the effects of noise. It's important to take aggravating factors into account when determining actions to protect workers' hearing health. Ototoxic substances and sources of vibration should be identified and taken into account.

In addition, the presence of workers already suffering from hearing loss may require special attention. Preventive measures should consider the specific needs and functions of workers.

These measures should be determined by a multidisciplinary team made up of the worker, their health professionals (e.g. physician, audiologist) and an employer representative. Hearing screening can help identify workers with hearing loss. It can be recommended by a team from the Réseau de santé publique en santé au travail (RSPSAT).

2.4. Legislation and best practices

Division XV of the *Regulation respecting occupational health and safety* (ROHS) specifies the obligations relating to the risks associated with exposure to noise in establishments. The measures called for by these obligations are the minimum to be implemented. As such, they should be supplemented, where necessary, by other means to better protect exposed workers. For effective management, one or more people should be designated to be responsible for the program and the prevention process. The employer must also encourage worker participation. Documents summarizing the noise regulations applicable in establishments are identified in section 9.1.

The regulatory noise exposure limits (NELs) are:

- daily noise exposure level: 85 dBA for 8 hours
- peak sound pressure level: 140 dBC (level never to be exceeded, regardless of duration)

However, to ensure better protection of workers' health and consider aggravating factors, it is recommended that appropriate preventive measures be implemented from 76 dBA upwards.

3. SECTORS OF ACTIVITY MOST EXPOSED TO NOISE

All sectors of activity expose workers to noise, but at varying levels. Certain sectors are known to be noisier, such as manufacturing and construction. Other sectors can also be noisy. Just think, for example, of workers in the performing arts, entertainment, sports or restaurants.

The table below illustrates some industries and fields with high proportions of workers exposed to intense noise levels:

	Proportion of workers exposed to intense noise levels	
	Between 20 and 30%	**More than 30%**

Sectors of activity	• Construction
	• Manufacturing:
	  ○ Wood and plywood
	  ○ Concrete products
	  ○ Steel industry
	  ○ Food and beverages
	  ○ Metal products
	  ○ Furniture
	  ○ Transportation equipment and materials
	  ○ Repair and maintenance of commercial and industrial machinery and equipment
	  ○ Repair and maintenance of motor vehicles
		• Paper manufacturing
		• Mining
		• Logging operations
		• Sawmills
		• Aluminum smelters
		• Foundries
		• Plastic or rubber products
		• Railway sector

Workers in the following occupations are among the most exposed to intense noise levels: textile and clothing manufacturing, sawmill and woodworking machine operators, machinists, welders, industrial electricians, plumbers, contractors, heavy equipment mechanics, industrial butchers and meat cutters.

Many machines and equipment cause very high daily exposures (>100 dBA/8 h). Examples include drills, chain saws, skidders, stock saws, planers, trimmers, debarkers, moulders, dust collectors, concrete saws, pneumatic (air-powered) tools, granulators, vibrating tables, strippers, branch chippers and blast cleaning equipment.

4. PREVENTION APPROACH

4.1. Identify and analyze risks

4.1.1. Identify risks

Employers must identify work situations where there is a risk of exposing workers to noise levels in excess of noise exposure limits (NELs). There are a number of identification methods. It is recommended to start by identifying noisy areas, equipment and processes.

Workplaces can then estimate noise levels without measuring instruments using:

- the voice test, which provides a qualitative estimate of the risk of exposure to noise levels above NELs. This test assesses the difficulty of holding a conversation with another person at a distance of one metre, and considers the presence of very noisy events of very short duration.
- databases or lists of recognized organizations available on the Internet. They can help to estimate exposure levels for similar tasks.
  Other sources specify the noise level emitted by certain tools or equipment.[3] However, this information must be used with care to ensure that the estimated level of risk reflects the reality of exposed workers.

A rough measurement can be made using an integrating sound level meter. Spot noise measurements will be obtained for the various zones or tasks. The CNESST calculator can be used to estimate the level of daily noise exposure from measurements of the various tasks that make up a normal working day.

Cell phone applications provide estimates of noise levels. However, their use is not recommended, as their quantitative results are often not very accurate. Even in the best cases, these applications are no substitute for a measuring instrument, such as an integrating sound level meter or dosimeter. Several conditions apply to ensure their proper use.

Measurement to CSA Z107.56-13, 2014 or ISO 9612:2009 standards can be used to meet the identification requirement. However, it is only compulsory once preventive measures aimed at elimination at the source, substitution or engineering controls have been implemented. This measurement must be carried out by a competent person with training in occupational hygiene or acoustics (see sections 6 and 7). In the absence of such training, this person must be familiar with best practices, standards, methods and measurement strategies. Measuring equipment (integrating sound level meter or dosimeter) must meet the requirements of one of these two standards.

4.1.2. Analyze risks

The health risk depends in particular on the level of exposure. The actions to be taken are therefore adapted based on the level of daily noise exposure (in dBA/8 h) or the peak sound pressure level (in dBC).[4]

[3] All the equipment needed for an activity (e.g. tools, vehicle, machine).

[4] The decibel (dB), A-weighted decibel (dBA) and C-weighted decibel (dBC) are units of measurement used to assess sound intensity.

Very high risk

Any work situation corresponding to one of the following statements:

- Daily noise exposure level greater than or equal to **100 dBA/8 h**
- Peak sound pressure level greater than **140 dBC**

Necessary actions:

- Rapidly implement measures to protect workers' hearing health (e.g. reduction in exposure time or adequate hearing protection)
- Plan and implement other preventive measures in accordance with the hierarchy of controls

Recommended actions:

- Contact the Réseau de santé publique en santé au travail (RSPSAT) occupational health physician to assess the relevance of adding hearing loss screening in the prevention program or action plan
- Modify work methods or equipment to eliminate or reduce impulse noise (very loud noise lasting less than a second, such as that produced by explosions, gunfire, pile driving or compressed air jets) causing high peak sound pressure levels
- Provide first aid for acute ear damage requiring rapid medical attention

High risk

Any work situation corresponding to the following statement:

- Daily noise exposure **from 86 to 99 dBA/8 h**

Necessary action:

- Implement measures to protect workers' hearing health (e.g. reduce exposure time or provide adequate hearing protection)
- Plan and implement other preventive measures in accordance with the hierarchy of controls

Recommended action:

- Contact the RSPSAT occupational health physician to assess the relevance of including screening for occupational hearing loss in the prevention program or action plan

Moderate risk

Any work situation corresponding to one of the following statements:

- Daily noise exposure **from 76 to 85 dBA/8 h**
- Peak sound pressure level **from 135 to 140 dBC**

Recommended actions:

- Identify aggravating factors
- Implement preventive measures in accordance with the hierarchy of controls
- Limit work methods or equipment that produce impulse noise
  (very loud noise lasting less than a second, such as those produced by explosions, gunshots, piling or compressed air jets)

Low risk

Any work situation corresponding to one of the following statements:

- Daily noise exposure level of **75 dBA/8 h and less**
- Peak sound pressure level of **134 dBC and less**

Necessary action:

- Carry out regular noise monitoring to quickly identify a change in any work situation that could increase the level of noise exposure

4.2. Correct risks

Once the at-risk work situations have been identified and the actions to be taken prioritized, corrective measures must be implemented to eliminate or reduce worker exposure. These corrective measures should be chosen in accordance with the hierarchy of controls. It is up to workplaces to determine which of these measures are applicable to their situation. Several preventive measures must sometimes be combined to adequately protect workers. A number of simple and often inexpensive solutions are applicable. Sections 4.2.1 to 4.2.5 provide some examples, and a guide is referenced in section 9.1 for more information.

4.2.1. Elimination at the source or substitution

These are the most effective measures. Here are a few examples:

- designing or laying out the workplace to reduce workers' noise exposure (e.g. separating workstations from noisy equipment, moving a noisy machine to an isolated area)
- implementing, substituting or modifying work methods or manufacturing processes (e.g. reducing the speed of a saw, screwing instead of nailing)
- purchasing low-noise equipment and tools (e.g. an electric tool is often less noisy than a pneumatic tool) or substituting less noisy equipment or tools
- regularly maintaining equipment based on manufacturers' recommendations

4.2.2. Engineering control

These measures act on the source and propagation of noise. Here are a few examples:

- modifying equipment to make it less noisy (e.g. adding mufflers on compressed-air valves, installing shock absorbers)
- enclosing noisy equipment
- installing panels or partitions made of soundproofing materials (e.g. acoustic foam, rock wool), acoustic curtains or screens
- distancing or isolating the workstation from the source of noise (e.g. moving a noisy compressor, working in a soundproof booth)

4.2.3. Signage

These measures improve workers' ability to identify work areas where there are risks associated with noise exposure. These may include signs indicating noisy work areas where hearing protection must be worn.

4.2.4. Administrative measures

These are measures to reduce exposure to noise or to encourage people to work safely.
Here are a few examples:

- rotating workers to different positions to reduce the duration of work exposure to the noisiest tasks; providing theoretical and practical training with reminders on the risks associated with noise exposure, as well as on the selection, use, maintenance and inspection of hearing protectors depending on the work situation (e.g. regular or irregular tasks, student jobs, seasonal or agency workers)
- posting exposure levels presented in measurement reports
- posting information on the effects of noise exposure

4.2.5. Personal protective equipment

The use of hearing protectors (e.g. ear muffs, plugs) should be considered as a last resort, when other measures are not feasible, when they are insufficient, or while waiting for their implementation to be completed. The use of hearing protectors must be combined with basic instruction and practical training.

There are several types and models of hearing protectors on the market. They each have advantages and disadvantages that need to be carefully weighed before making a choice. To optimize their efficiency, they must:

- comply with the standards set out in the legislation
- be fitted to each worker, form an airtight seal, be comfortable and properly worn for the duration of noise exposure
- be adapted to the work situation (e.g. noise level, use of other personal protective equipment, environmental conditions, communication and sound perception needs such as alarm signals)

4.3. Control risks

Controls are designed to ensure that the corrective measures taken stay in place and remain effective.

Regular environmental monitoring enables the rapid identification of any changes in work situations that could increase noise exposure. This identification is mandatory.

The available means of elimination, substitution or engineering controls must be reassessed at least every five years. The new means available must be implemented.

The following information must be recorded in the prevention program or in a register:

- risky work situations and the dates on which they were identified
- control measures implemented and the start and end dates of their implementation
- measurement reports

It is also recommended to:

- institute a purchasing policy that favours equipment producing less noise
- plan preventive maintenance on machines, equipment, tools, equipment, or vehicles
- develop a hearing loss prevention program
- carry out regular checks to ensure that hearing protectors are worn and used properly when required for optimum protection

5. FIRST AID

The immediate effects of acute noise exposure are a medical emergency requiring rapid treatment to limit complications. The *First-aid Minimum Standards Regulation* requires the presence of a trained first-aider ready to react in a variety of circumstances. The first-aider and the employer should be aware that at the first symptoms of sound trauma, the worker should be referred promptly to the appropriate medical resources for assessment and treatment.

6. MEDICAL SUPERVISION

According to the criteria established by the Comité médical provincial en santé au travail du Québec, screening for occupational hearing loss should be carried out when a worker is exposed to more than 85 dBA over 8 hours. All occupational hearing loss screening must be carried out in accordance with the *Recommendations of the public health network for occupational health for audiometric examinations in workers exposed to noise* (in French only) and the *Guide to the use of audiometric examinations in the public health network for occupational health* (in French only).

Workplaces with a high or very high risk of noise exposure should contact their occupational health team or an occupational health physician. They will determine whether screening is required, considering the worker's exposure and work history. In addition, the guidelines of the *Practice guide concerning the worker's free and informed decision in the context of occupational health screening or medical surveillance (2019)* (in French only) should be applied during medical surveillance.

Workers exposed to noise should be screened for occupational hearing loss. This medical surveillance is in addition to the preventive measures implemented in the workplace.

7. SERVICES OFFERED BY RSPSAT TEAMS

The Réseau de santé publique en santé au travail (RSPSAT), together with its partners and in accordance with its legal mandates under the *Act respecting occupational health and safety* (AOHS), the *Public Health Act* (PHA) and the *Act respecting health services and social services* (AHSSS), works to prevent and protect workers' health by supporting workplaces in meeting their obligations to prevent occupational illnesses. The RSPSAT has multidisciplinary teams (medical, nursing, occupational hygiene, ergonomics, psychosocial risks, etc.) with expertise in occupational health that are entirely funded by the Fonds de la santé et de la sécurité du travail. It has been offering its services free of charge throughout Quebec since the adoption of the AOHS in 1979.

More specifically, with regard to the risk posed by noise exposure, the RSPSAT can:

- help identify exposure risks and measure noise exposure levels
- assist with risk analysis and prioritization of noise-related actions
- provide support in selecting, implementing and evaluating the effectiveness of preventive measures
- provide information on the risks of noise exposure, on preventive measures, and on the selection, fitting and use of hearing protectors
- offer support for developing a hearing loss prevention program
- carry out or organize hearing loss screening for workers exposed to noise
- carry out risk assessments and make medical recommendations as part of the For a Safe Maternity Experience program (FSME)

To request support or find out more about the services offered by the occupational health teams, consult www.santeautravail.qc.ca.

8. SERVICES OFFERED BY OTHER PARTNERS

The CNESST's other partners help support workplaces in their OHS management efforts in many ways. The joint sector-based associations (JSAs) provide their members with services:

- advice and personalized assistance
- training and information
- research and development on the prevention of work-related accidents and illnesses

If you're linked to a JSA, you can find out about the specific services it offers its members.

9. FOR MORE INFORMATION

9.1. Additional information for workplaces

Web pages

- CNESST, *Exposure to noise* (in French only)
- CNESST, *Hearing protectors* (in French only)
- CNESST, *Calculator for assessing the daily net exposure* (in French only)

Documents

- CNESST, *Management of risks related to exposure to noise in the workplace – Identification and measurement guide* (in French only), 2025
- CNESST, *Communication test in noise – Voice test* (in French only), 2023
- CNESST, *Management of risks related to exposure to noise in the workplace – Guide on means to reduce worker exposure* (in French only), 2023
- CNESST, *Management of risks related to exposure to noise in the workplace – Guide on selecting and using hearing protectors* (in French only), 2023

Documents summarizing the regulations

- CNESST, *Diagram summarizing the main steps planned in the division relating to noise of the ROHS* (in French only), 2023
- CNESST, *Maximum timeframes applicable to noise provisions in the Regulation respecting occupational health and safety (ROHS) in effect since June 16, 2023* (in French only), 2024

Laws and regulations

- *Act respecting occupational health and safety* (AOHS)
- *Regulation respecting occupational health an safety* (ROHS) Réseau de santé publique

en santé au travail (RSPSAT)

- Theme folder on noise (in French only).

Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST)

- Instrument loan, calibration and repair services (in French only).
- Ouellet F. et al., *Choosing a safe and effective blow gun* (in French only), 2014.
- *Portable pneumatic tools – Protecting your ears and hands* (in French only), 2010.

9.2. Additional information for specialists

CNESST

- To consult standards or other documents specific to the topic: Centre d'information scientifique et technique de la CNESST

Réseau de santé publique en santé au travail (RSPSAT)

- Comité médical provincial d'harmonisation Pour une maternité sans danger (CMPH-PMSD), *Practice guide for the preventive withdrawal of pregnant or breastfeeding workers – Effects of noise on pregnancy* (in French only), 2012.
- Comité médical provincial en santé au travail du Québec, *Guide to the use of audiometric examinations in the public health network for occupational health* (in French only), 2015.
- Comité médical provincial en santé au travail du Québec, *Recommendations of the public health network for occupational health for audiometric examinations in workers exposed to noise* (in French only), September 2023.
- Groupe de travail sur le consentement éclairé en santé au travail, *Practice guide concerning the worker's free and informed decision in the context of occupational health screening or medical supervision* (in French only), 2019.

Institut national de santé publique du Québec (INSPQ)

- Web page *Noise exposure and effects on health and safety* (in French only).
- Martin, R. et al., *Practice guide for identifying and measuring workers' exposure to noise* (in French only). *INSPQ,* 2024.
- *Exposure of Quebec workers to intense noise in the workplace: results from the Quebec health survey* (in French only), 2020–2021, (forthcoming).

The CNESST and the MSSS would like to thank the following partners for their participation in the development of occupational health programs:

ASSOCIATIONS SECTORIELLES PARITAIRES
Institut national de santé publique Québec
irsst
Réseau de santé publique en santé au travail
Québec Santé Québec

For general information, contact the CNESST.