INRS

HAND-ARM VIBRATION SYNDROME

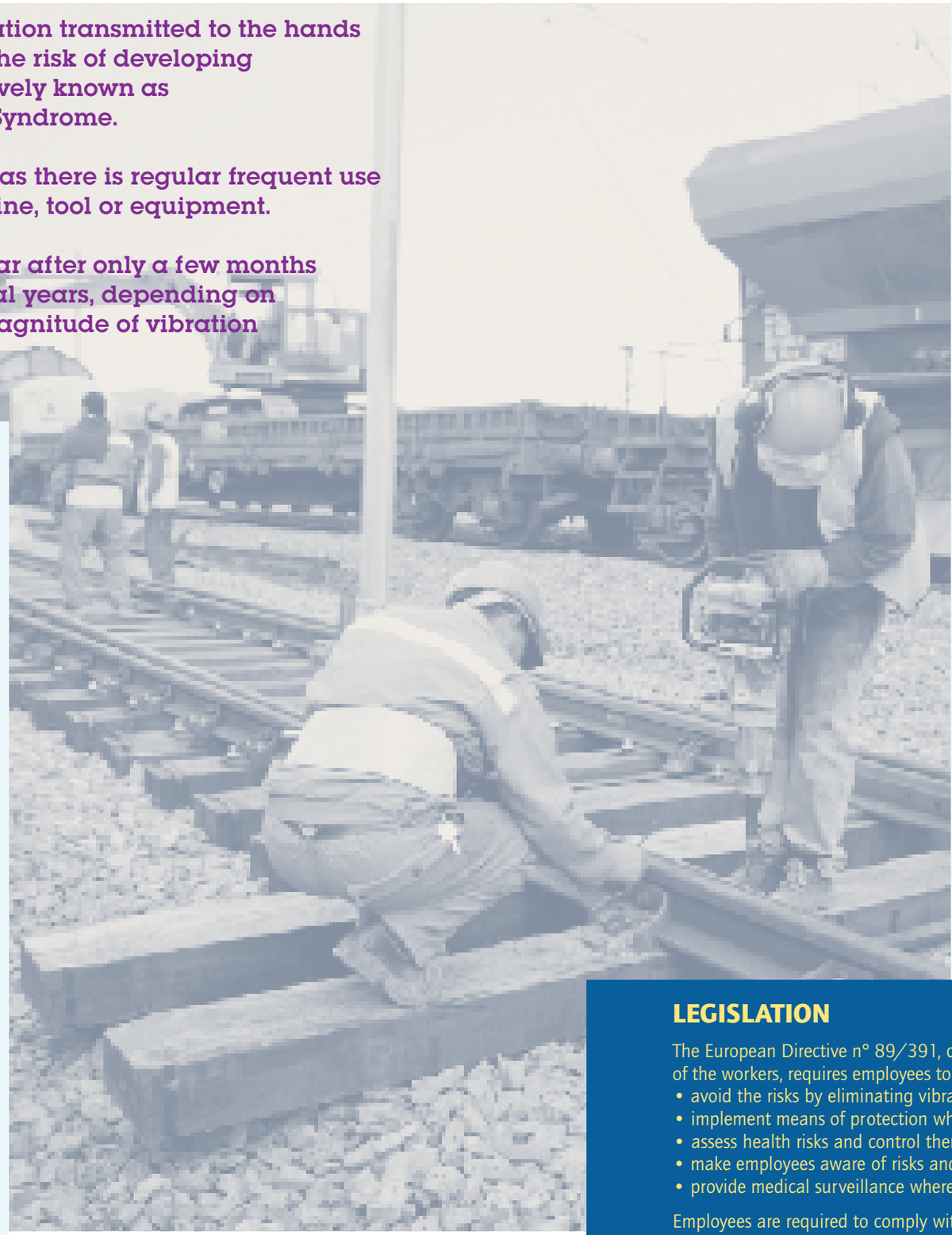
THE HAND IN DANGER

CONCRETE BREAKERS, CHIPPING HAMMERS, GRINDERS,
RIVETING HAMMERS, CHAIN SAWS, IMPACT WRENCHES, ETC.

Regular exposure to vibration transmitted to the hands and arms may increase the risk of developing chronic disorders collectively known as the Hand Arm Vibration Syndrome.

The risk appears as soon as there is regular frequent use of a high-vibration machine, tool or equipment.

First symptoms can appear after only a few months or may be delayed several years, depending on the individual and the magnitude of vibration applied to the hand.



ALL WORKERS USING VIBRATING MACHINERY OR HAND-TOOLS ARE AT RISK OF DEVELOPING THE HAND-ARM VIBRATION SYNDROME

Over 5% of employees are regularly exposed to hand-transmitted vibration in many branches of activity : building and civil engineering, road and railway maintenance, forestry work, foundries and mechanical engineering workshops, mines and quarries, etc.

Many hand-held or hand-guided tools generate vibration. Vibration levels can be high in some of these tools including chain saws, concrete breakers, grinders, perforators, strippers, plate vibrators, lawnmowers, nailers, etc.

Vibration is transmitted into an operator's hands and arms through physical contact with the tool. In some cases, vibration is transmitted through a hand-held work-piece when using a pedestal grinder.

THINK FIRST... POSSIBLE IRREVERSIBLE INJURIES IN THE LONG TERM

The first symptoms may be discomfort of the fingers, hands or joints : numbness, tingling, functional problems.

These evolve into :

- impaired sense of touch and impaired perception of hot and cold,
- reduced grip strength and loss of manual dexterity,
- finger blanching attacks triggered by exposure to cold or dampness,
- pain in the hands and arms.

In the long term, the injury can be irreversible. The hand-arm vibration syndrome can involve damage to blood vessels in the fingers and hand (white fingers), the peripheral nervous system, tendons, muscles, and bones and joints of the hands and arms.

The hand-arm vibration syndrome may also interfere with leisure activities in personal life. Reduced dexterity of the fingers, hands or joints may increase the risk of accidents when operating tools and machines, especially those requiring a high degree of dexterity and precision.

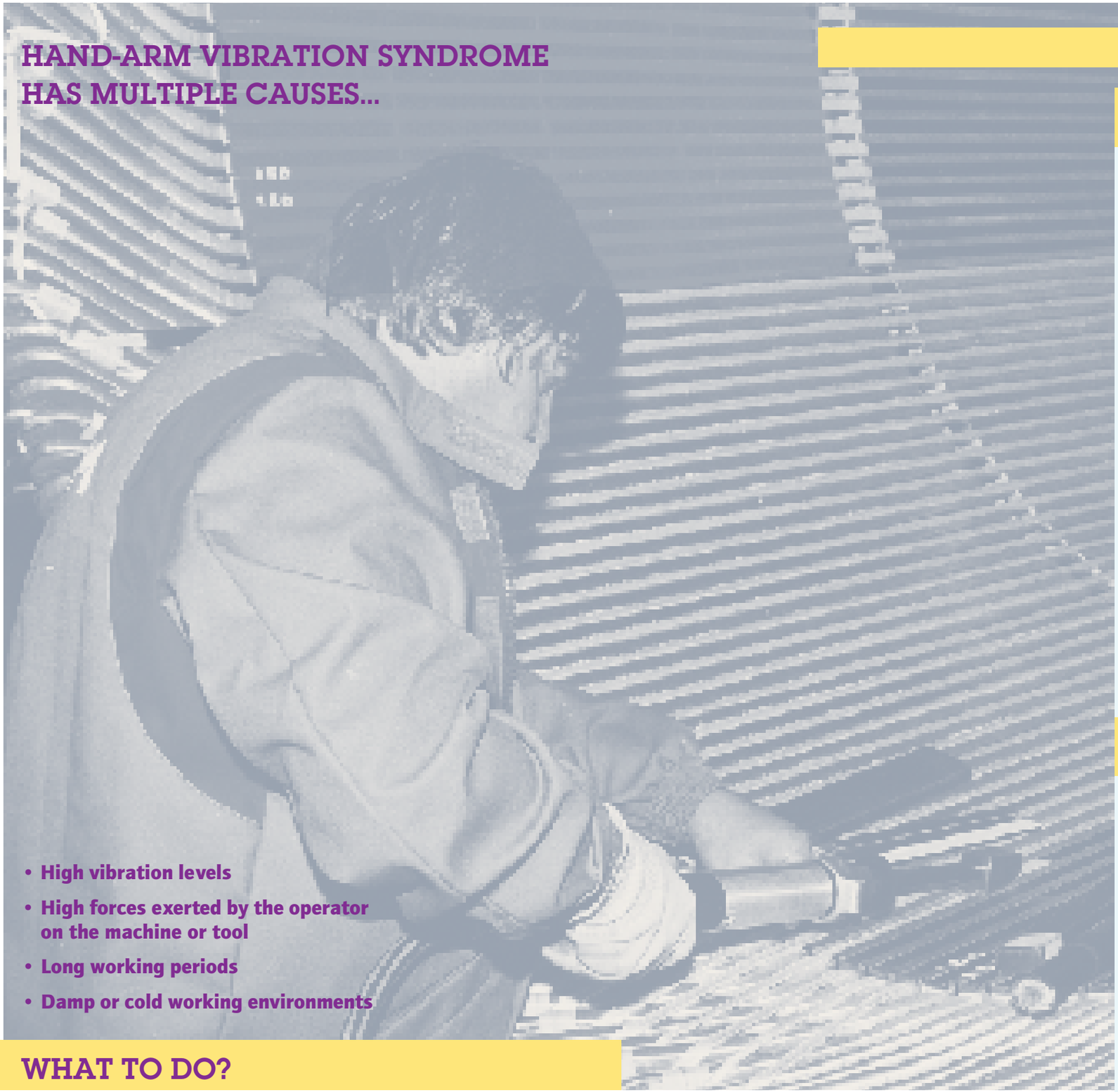
LEGISLATION

The European Directive n° 89/391, concerning the safety and health of the workers, requires employees to :

- avoid the risks by eliminating vibration where possible,
- implement means of protection which reduce or suppress the risks,
- assess health risks and control them,
- make employees aware of risks and train them to work-safety,
- provide medical surveillance where there is still a risk.

Employees are required to comply with safety instructions.

HAND-ARM VIBRATION SYNDROME HAS MULTIPLE CAUSES...



- **High vibration levels**
- **High forces exerted by the operator on the machine or tool**
- **Long working periods**
- **Damp or cold working environments**

WHAT TO DO?

IDENTIFY RISK SITUATIONS

Estimate the vibration magnitude

Vibration values declared by the manufacturer of a tool or machine in accord with the EU Machinery Directive can be useful for comparison purposes. However they may underestimate the severity of vibration exposure in some jobs.

A more reliable evaluation of the vibration can be gained by referring to measurements obtained for comparable operations. A tool vibration measurement database is on the Internet : http://umetech.niwl.se.

This database permits identification of the vibration expected on many vibration machines and tools. Il there are no measurements available for the machine or tool concerned, maximum values obtained on similar machines can provide guidance.

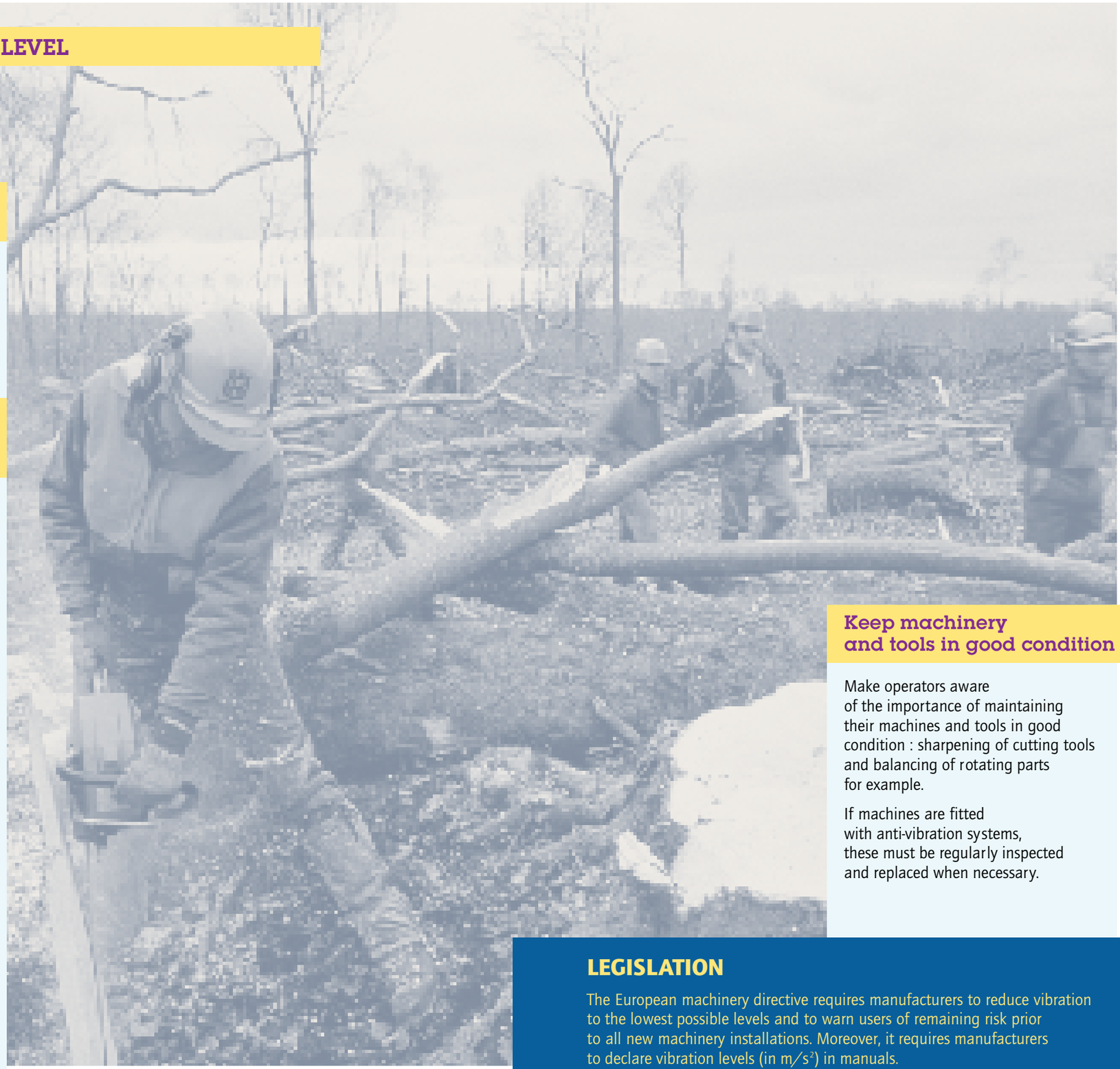
Only measurements taken during the work activity allow accurate definition of the vibration level generated by a machine or tool where this is required. The intervention of an occupational hygiene specialist may be advisable to assess exposure, identify any risk and recommend any preventive measures.

Estimate the exposure

The risk depends on the type of vibration and the exposure duration. International standard ISO 5349 states that an exposure of approximately 2.5 m/s^2 over an 8 hour period is likely to cause white fingers in about 10% of persons exposed for 12 years. The same proportion would be affected after an exposure to 5m/s^2 (2 times greater) for 2 hours per day (4 times less) over the same 12 year interval.

The vibration exposure is evaluated on the basis of the 8-hour equivalent exposure level, that is, the continuous level over 8 hours that would give the same vibration energy as the actual exposure.

REDUCE THE VIBRATION LEVEL



Alter working practices

In some cases, vibration can be reduced or even eliminated by adopting alternative practices, or by changing the product or its packaging.

Select the machinery, tools and equipment that vibrate the least

Include a "vibration" section in your future equipment specifications stating that vibration must be as low as possible. The hand may be in danger at 2.5 m/s^2 and is very likely to be at risk above 5 m/s^2. Vibration values given in manuals by equipment manufacturers may provide help in comparing machines, but quoted levels may be lower than those in real situations, which can vary considerably from one job to another. Suppliers should be asked for information on the likely vibration levels for the intended use of the equipment.

Select the machine and tool on the basis of the job to be performed : operating an unsuitable machine or tool compels the operator to exert greater forces, sometimes for a longer time. The operator can then be exposed to greater vibration levels and increased risk of developing the hand-arm vibration syndrome. Check that anti-vibration systems do not reduce the machine's efficiency : a less efficient machine or tool will have to be used longer !

Keep machinery and tools in good condition

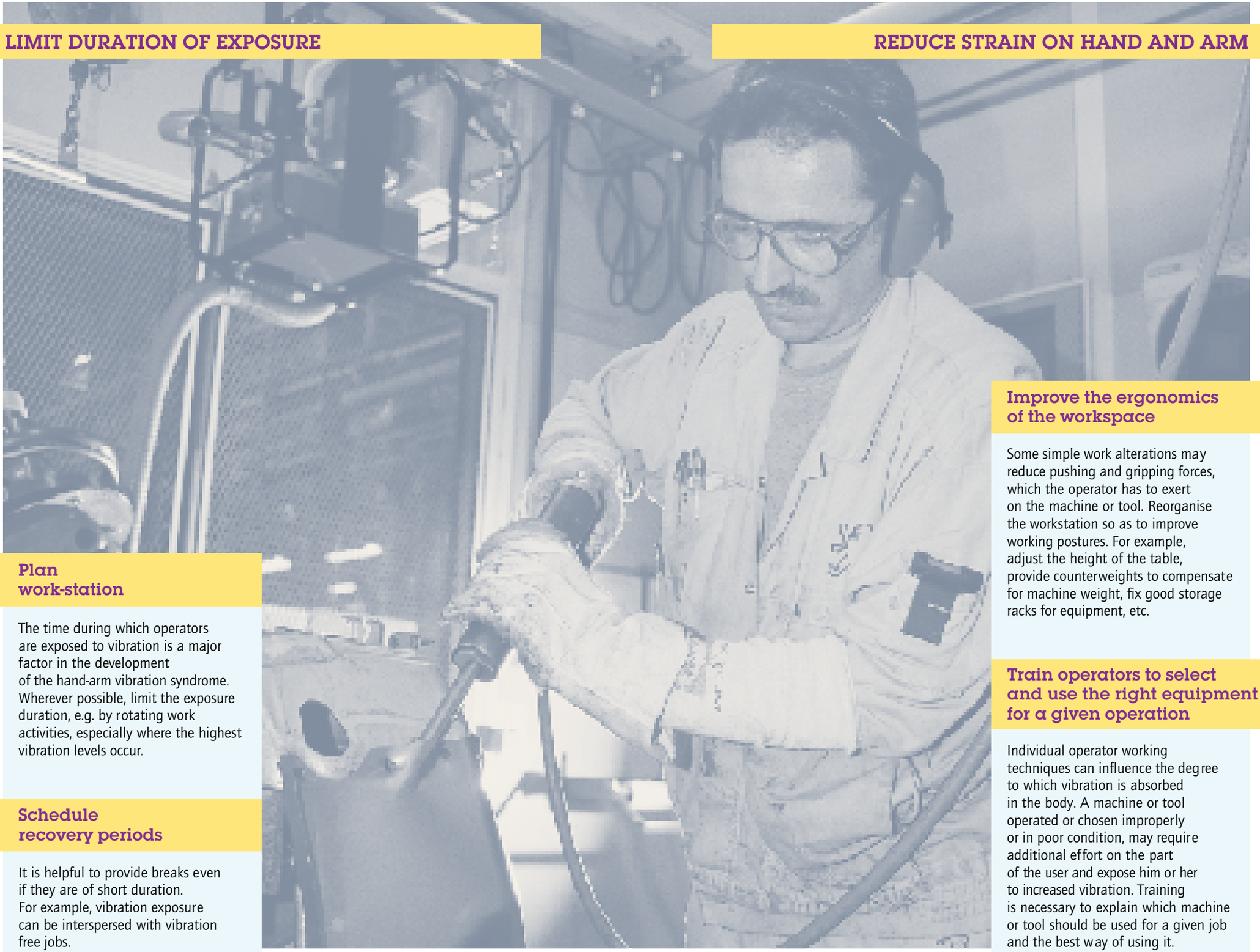
Make operators aware of the importance of maintaining their machines and tools in good condition : sharpening of cutting tools and balancing of rotating parts for example.

If machines are fitted with anti-vibration systems, these must be regularly inspected and replaced when necessary.

LEGISLATION

The European machinery directive requires manufacturers to reduce vibration to the lowest possible levels and to warn users of remaining risk prior to all new machinery installations. Moreover, it requires manufacturers to declare vibration levels (in m/s^2) in manuals.

LIMIT DURATION OF EXPOSURE



Plan work-station

The time during which operators are exposed to vibration is a major factor in the development of the hand-arm vibration syndrome. Wherever possible, limit the exposure duration, e.g. by rotating work activities, especially where the highest vibration levels occur.

Schedule recovery periods

It is helpful to provide breaks even if they are of short duration. For example, vibration exposure can be interspersed with vibration free jobs.

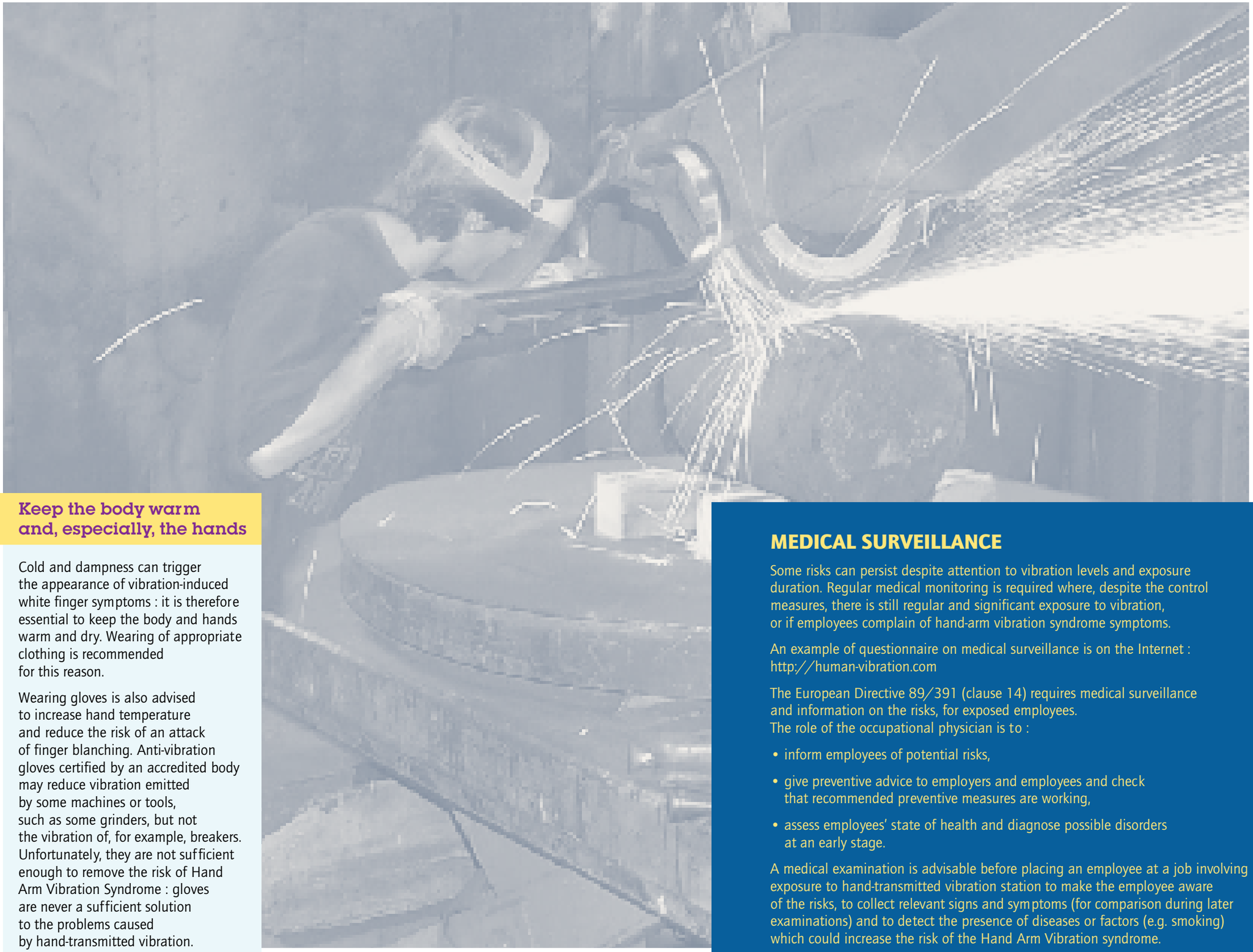
REDUCE STRAIN ON HAND AND ARM

Improve the ergonomics of the workspace

Some simple work alterations may reduce pushing and gripping forces, which the operator has to exert on the machine or tool. Reorganise the workstation so as to improve working postures. For example, adjust the height of the table, provide counterweights to compensate for machine weight, fix good storage racks for equipment, etc.

Train operators to select and use the right equipment for a given operation

Individual operator working techniques can influence the degree to which vibration is absorbed in the body. A machine or tool operated or chosen improperly or in poor condition, may require additional effort on the part of the user and expose him or her to increased vibration. Training is necessary to explain which machine or tool should be used for a given job and the best way of using it.



Keep the body warm and, especially, the hands

Cold and dampness can trigger the appearance of vibration-induced white finger symptoms : it is therefore essential to keep the body and hands warm and dry. Wearing of appropriate clothing is recommended for this reason.

Wearing gloves is also advised to increase hand temperature and reduce the risk of an attack of finger blanching. Anti-vibration gloves certified by an accredited body may reduce vibration emitted by some machines or tools, such as some grinders, but not the vibration of, for example, breakers. Unfortunately, they are not sufficient enough to remove the risk of Hand Arm Vibration Syndrome : gloves are never a sufficient solution to the problems caused by hand-transmitted vibration.

MEDICAL SURVEILLANCE

Some risks can persist despite attention to vibration levels and exposure duration. Regular medical monitoring is required where, despite the control measures, there is still regular and significant exposure to vibration, or if employees complain of hand-arm vibration syndrome symptoms.

An example of questionnaire on medical surveillance is on the Internet : http://human-vibration.com

The European Directive 89/391 (clause 14) requires medical surveillance and information on the risks, for exposed employees.
The role of the occupational physician is to :

- inform employees of potential risks,
- give preventive advice to employers and employees and check that recommended preventive measures are working,
- assess employees' state of health and diagnose possible disorders at an early stage.

A medical examination is advisable before placing an employee at a job involving exposure to hand-transmitted vibration station to make the employee aware of the risks, to collect relevant signs and symptoms (for comparison during later examinations) and to detect the presence of diseases or factors (e.g. smoking) which could increase the risk of the Hand Arm Vibration syndrome.

A large number of employees in many branches of activity are exposed to Hand-Transmitted Vibration. The risk of the Hand Arm Vibration Syndrome exists as soon as a hand-held high-vibration machine, tool or equipment is used on a regular basis.

This leaflet aims to help employers, and other responsible for the prevention of occupational risks, to become aware of the risks of exposure to hand-transmitted vibration and to adopt measures to improve safety and health in their companies.

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