INLAND WATERWAYS ASSOCIATION

GUIDANCE NOTE

Dust & Fumes (Respiratory Hazards)

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INTRODUCTION

Volunteers working on a restoration project may not realise that dust and fumes are a hazard because they are working in the open air, which is seen as healthy. But several activities on restoration sites create dust and fumes which are respiratory hazards. Materials such as cement and lime release dust when being mixed. Cutting bricks and blocks generates silica dust. Exhaust fumes from plant and equipment can be toxic or may pollute the atmosphere within an enclosed space. Vapours or fumes may be given off when chemicals are mixed or used, such as fumes from a solvent based paint.

Substances which pose a respiratory hazard cause harm to human health through inhalation.

There are two types of respiratory illness:

Chronic

These can take many years to develop and can be debilitating or fatal. They include cancer, silicosis, asthma and chronic obstructive pulmonary disorder (COPD).

Acute

Cause illness or death after short exposures, such as to carbon monoxide or welding fumes. The effects may appear rapidly. Some substances which pose a respiratory hazard can cause both chronic and acute illness depending on the dose. Substances can be harmful at low concentrations or from short-term exposure. Chronic illness may continue to develop after exposure to the substance has finished.

CONSTRUCTION INDUSTRY STATISTICS (FROM CITB)

Work-related respiratory ill health has devastating consequences for individuals and their families but it is very much misunderstood or underestimated.

- Around 13,000 deaths each year from occupational lung disease and cancer.
- Estimated that over 40% of new cancer registrations/deaths are to construction workers.
- Estimated that more than 500 construction workers die from exposure to silica dust every year....more than 10 per week.
- Many more suffer life-changing respiratory illnesses.
- 23.5 million working days lost in the UK to work-related respiratory ill health each year.

Volunteers need to be made aware of the dangers of being exposed to respiratory hazards and be protected against them.

TYPES OF RESPIRATORY HAZARD

Respiratory hazardous substances take many forms. They are characterised by very small particle sizes which can be inhaled into the lungs.

Dust is produced when solid materials are broken down into finer particles, from activities like drilling, angle grinding and sawing. Dusts can be created when sweeping or from accumulations that are disturbed by wind. Respirable dusts are particles of a size smaller than 10 microns (one micron is 1000th of a millimetre) and are harmful as they have the ability to be deposited in the lungs and are not visible to the naked eye.

Mists and aerosols are tiny droplets of liquid formed by atomisation, for example by spraying or using an aerosol and may be harmful because of the liquid they are formed from. They can contain biologically hazardous substances as well as chemicals.

Gases are substances in a gaseous form at room temperature which mix with the air that we breathe, such as carbon dioxide, carbon monoxide and hydrogen sulphide. Harmless gases may pose a problem in enclosed spaces due to the dilution of the oxygen in the air.

Vapours are formed when substances that are liquid or solid at room temperature evaporate, such as solvents from glue or paint. Petrol and organic solvents are highly volatile, giving off vapours at room or low temperatures. Vapours can be toxic when inhaled causing dizziness, unconsciousness, and ultimately death. Vapours can build up to dangerous concentrations in enclosed spaces.

Fumes are a mixture of gases and particles, which may be created during welding or gas cutting, where microscopic particles of metal are generated and can be inhaled. Exhaust fumes from vehicles or plant and smoke from bonfires may contain carbon monoxide, soot and unburnt hydrocarbons. Fumes can build up to dangerous levels in enclosed spaces.

CHRONIC RESPIRATORY DISEASES

Long term exposure to respiratory hazards can lead to chronic respiratory diseases. These often develop over a long period of time and are irreversible.

Repeated exposure to small doses of respiratory hazards start to damage the body, which can lead to serious disease in time.

Examples of chronic respiratory diseases are:

1. Chronic obstructive pulmonary disease.
2. Silicosis.
3. Asbestosis.
4. Respiratory cancers.
5. Pleural thickening.
6. Occupational asthma.

WORKPLACE EXPOSURE LIMITS

When planning work you should be aware of the workplace exposure limits for dust.

The dose of respiratory hazardous substance is a combination of the concentration in the air and the period of exposure and is expressed as a **Time Weighted Average** (TWA) over an eight hour working day or, where a substance has an acute effect following short-term exposure, a 15 minute TWA. The HSE has published tables of Workspace Exposure Limits (WEL) in document EH40.

WEL for all dust is 10mg.m^3, (eight hour TWA) and within this figure there is a maximum of 4 mg.m^3 for respirable dust. The WEL for respirable chrystalline silica is 0.1mg.m^3. When these figures are exceeded the dust becomes a substance hazardous to health and the Control of Substances Hazardous to Health Regulation (COSHH) apply. Refer to the guidance note on COSHH.

MANAGING THE RISK

COSHH requires employers (in the case of restoration the employer is the restoration group) to carry out a suitable and sufficient assessment of the risk of exposure and, so far as reasonably practicable, to apply adequate controls.

Health risks to volunteers as a result of exposure to respiratory hazards must be adequately controlled by using the following principles:

1. Minimise emission, release and spread of substances by designing and operating suitable processes and activities. For example, use a slab splitter rather than saw cutting paving slabs. Plan paving to reduce the number of cuts or design in the routes for services rather than cutting them later.

2. Minimise the escape and spread of substances by using the most effective and reliable control options. For example use water to dampen down dust generation. Water cannot be used on electric tools or when cutting wood, so on-tool dust extraction should be considered which collects dust in a specially designed hood, but will only remain effective if fitted correctly and emptied at regular intervals.

3. Extract the dust in the air using forced ventilation. Contaminated air is extracted from an enclosed space and clean air is drawn in.

4. Provide personal protective equipment (PPE) where adequate control measures cannot be achieved by other means. Not all dust is collected by extraction or suppressed by water and respiratory protective equipment (RPE) will be required to provide extra protection.

5. Check and review all elements of control regularly.

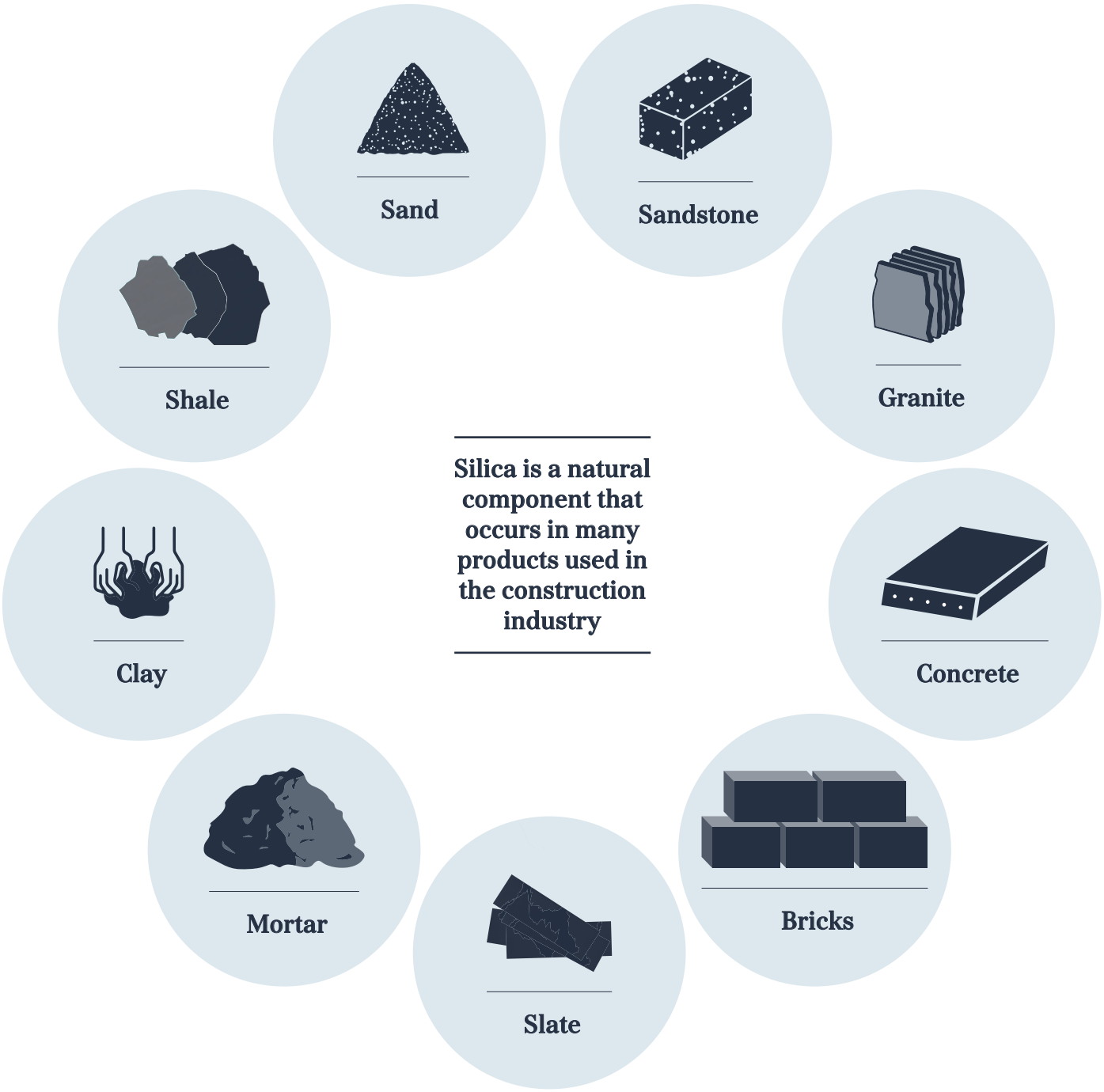
6. Train and inform volunteers of the hazards and risks of the substances and the control measures developed to minimise the risks. Instruction should be part of the site induction and include the procedure for reporting defective or inadequate equipment or methods. Instruction should include the correct use of PPE/RPE, its cleaning, maintenance and storage. Volunteers will need to be supervised in the correct use of equipment and safe systems of work.

7. Ensure the control measures do not increase overall risk by creating other hazards such as using water to dampen dust on electric tools.

The Construction (Design and Management) Regulations (2015) (CDM) require designers to eliminate, reduce or control foreseeable risks, such as specifying materials are cut to size at point of manufacture to avoid workers completing the work and increasing their exposure to respiratory risks. Principal contractors are required, under CDM, to ensure that the methods of construction are suitable to adequately control risks.

COMMON RESPIRATORY HAZARDS

Two of the most common respiratory hazards on a restoration site are silica, from the construction materials used on site, and carbon monoxide, from the exhaust fumes of plant and equipment operating on the site.



The health hazard associated with silica is from breathing in the dust created when working with stone, grit blasting, scabbling, cutting or drilling and demolition. Silicosis is caused by inhaling silica dust and is the hardening of the lung tissue and consequent loss of lung function. The condition is irreversible and continues to develop after exposure has stopped. Health and Safety Executive (HSE) has published guidance on the control of exposure to silica dust, a link is included in Useful Resources on p.15.

CARBON MONOXIDE

Carbon monoxide is created by incomplete combustion and is colourless, odourless and tasteless and is a toxic gas.

It can be an issue on construction sites in the following circumstances:

1. Where portable liquefied petroleum gas (LPG, such as butane and propane) is used and there is inadequate ventilation.
2. Where combustion engine powered equipment is used in an enclosed or confined space.

Carbon monoxide causes oxygen deprivation in body tissues and is classified as a chemical asphyxiant. Low levels of intoxication may cause headaches and tiredness, which will disappear when the person leaves the area where carbon monoxide is present.

Higher concentrations of carbon monoxide exposure can cause:

1. Pains in the chest and stomach.
2. Nausea.
3. Breathlessness.
4. Visual problems.
5. Erratic behaviour and decreased mental performance.
6. Collapse and loss of consciousness.

If a casualty is removed from the environment where there is a high concentration of carbon monoxide present before death, they should make a full recovery. First aid treatment for a carbon monoxide poisoned casualty is removal to fresh air and, if necessary, treatment with 100% oxygen by the emergency services.

The risks associated with using LPG heaters and cookers can be eliminated by using electric equipment. Where LPG is the only option ensure there is sufficient ventilation around the cylinders, the equipment is properly installed and maintained, the ventilation is not blocked and cylinders are properly turned off when not in use. Users of facilities should be made aware of the need to maintain ventilation. A carbon monoxide detector mounted on the wall or ceiling can be used as an additional safety measure.

Exhaust emissions from combustion equipment contain carbon monoxide and other toxic and carcinogenic substances. There is a risk to health where combustion engines are used where there is not a free flow of ventilation and, where possible, electric equipment should be used instead.

A build up of carbon monoxide can occur where equipment is used in poorly ventilated enclosed spaces such as a building under restoration or an empty lock chamber. The level of carbon monoxide should be monitored.

Refurbishment work on existing buildings can lead to carbon monoxide poisoning following the work if gas flues or ventilation systems have been disturbed. Prior to work, a competent Gas Safe engineer should undertake an assessment to ensure work will not affect gas-fired systems. Gas systems should be isolated during the work and any work to a gas installation should be carried out by a Gas Safe engineer. On completion, the gas installation must be re-inspected by a Gas Safe engineer.

RESPIRATORY PROTECTIVE EQUIPMENT

When the exposure to respiratory hazardous substances cannot be adequately controlled by other means volunteers should be provided with personal respiratory protective equipment, RPE. Refer to the guidance note on Personal Protective Equipment.

Under Personal Protective Equipment Regulations an assessment must be made to determine when RPE is required and what type is appropriate for controlling exposure to the substance.

Choice of RPE will depend on a number of interacting factors:

1. The nature of the hazards and materials.
2. The concentration of dust anticipated.
3. The period of exposure.
4. If working outdoors, the prevailing weather conditions.
5. Suitability for each user (field of vision, provision for communication and the need to move in cramped or difficult places).
6. Compatibility with any other PPE that is being used.

Manufacturers assign a protection factor to their RPE which indicates the expected level of performance of the equipment.

For example half face masks:

1. **FFP1 or P1** low efficiency device offering protection factor four.
2. **FFP2 or P2** medium efficiency device offering protection factor 10.
3. **FFP3 or P3** high efficiency device offering protection factor 20.

A protection factor relates the concentration of dust outside the mask compared to inside it. For a P2 mask for every 10 particles outside the mask predicts that one will penetrate it. Know the likely concentration of the substance and the WEL for that substance before selecting the mask.

It is recognised good practice to use RPE with an FFP3 rating to protect against dust created when cutting concrete, bricks etc even when wet cutting which removes around 60 – 75% of airborne particles.

The types of respiratory devices approved for use are:

1. Disposable half mask respirators.
2. Reusable half mask respirators.
3. Powered respirators.
4. Ventilated visors and ventilated helmet respirators.
5. Air-fed breathing apparatus.
6. Self-contained breathing apparatus.

The performance of tight-fitting RPE is dependent on a good contact between the wearer's skin and the seal of the face piece. The shape and size of the face means that one type or size of RPE would not suit everybody and different designs may be required. Facial hair will significantly reduce the protection provided. Training volunteers in the correct use of RPE is essential before first use and should be repeated at suitable intervals.

Training should cover:

1. Why RPE is necessary.
2. Why face-fit testing might be necessary.
3. What maintenance is required.
4. Use and misuse of RPE.
5. Where and how to clean the RPE and store it.
6. How to wear and check the RPE correctly.
7. What RPE is to be provided.
8. The hazards, risks and effects of exposure.
9. How the RPE works.
10. The responsibilities of the volunteers.
11. How to report defects in the RPE or any other problem with it.

Both the restoration group and volunteer have a duty to ensure that RPE is used and stored correctly after use. Non-disposable RPE should be thoroughly examined and tested at appropriate intervals. Disposable RPE should be used for one working shift and then disposed.

EXAMPLES ON A RESTORATION SITE

Here are some examples where dust could be a problem on a restoration site and some suggested solutions to protect your volunteers. The amount of dust generated can be reduced but is unlikely to be eliminated altogether. Some form of RPE will be required and you must decide on the type required for the particular activity. Other PPE, such as eye and hearing protection may also be required and the choice of RPE must take this into account. For any RPE the user will need instruction in the correct way to use it and supervision during use. Dust generated during work activities will collect on clothing and care will need to be exercised when removing the clothing not to release or inhale the dust.

1. **Concrete / mortar mixing**
   Dusts are created when dry materials are added to the mixer. Lime and cement are hazardous, but dust particles in the sand or aggregate could contain silica. When mixing add the water to the mixer first. Use gauging buckets to measure the quantities of dry materials needed and pour the materials into the mixer. To reduce the manual handling risk, site the mixer close to the materials. Do not look closely into the drum during mixing. Fold empty cement and lime bags to contain any loose material and place the empty bags in an empty bag or other container. A half face mask is required for added protection.

2. **Brick, block, masonry and paving cutting**
   Where possible use a block or paving splitter that applies pressure to split the item. A hammer and chisel can be used to cut bricks and blocks, but will generate some dust and flying fragments. A brick saw will generate dust, which can be suppressed by attaching a water supply. Not all dust will be eliminated and it is best to dedicate an area where cutting is carried out to reduce the risk to others not involved in the activity. A half face mask is required for added protection.

3. **Drilling brick, concrete and masonry**
   The high speed and hammer action of the drill will create dust. Always use sharp drill bits. Avoid drilling at chest, eye or above head level. Use a platform to elevate the operator to the right level. Forced ventilation may be required in enclosed spaces. A half face mask is required for added protection.

4. **Woodworking**
   Sawing, planing, sanding and drilling wood will create dust. Many power tools include a dust collecting bag, which should be fitted correctly and emptied regularly. Use sharp tools. A half face mask will provide added protection.

5. **Preparing paintwork**
   Where possible use wet sanding or brushing. Power sanders include a dust collecting bag, which should be used as described above. A half face mask is required for added protection.

6. **Chasing walls and removing old pointing**
   Use hand tools where possible. In addition to reducing the generation of dust these help preserve the parent materials. Where power tools have to be used, they should be fitted with dust extraction and the vacuum collector should be emptied and the filters cleaned or replaced regularly. A full-face mask is required for added protection when power chasing, but a half face mask will be required for use with hand tools.

7. **Excavation and transport around site in dry conditions**
   In dry conditions dust can be generated from general site activities including moving around the site. The material content is likely to be unknown due to the nature of the site and any previous uses. Travelling at a slower speed and loading spoil from a lesser height will reduce dust generation. Windy conditions would increase the generation of airborne dust. In these circumstances damping down with water should be considered.

8 **Sweeping-up**
For indoor locations vacuum the dust where possible. In all situations dampening down the area with water before sweeping will reduce the generation of dust but may make it more difficult to sweep cleanly. Dispose of the dust in sealed bags. A half face mask will provide added protection to the volunteer doing the sweeping.

9 **Working in confined spaces**
Obvious confined spaces are small enclosed spaces, but by definition some areas on a restoration site will be classified as confined spaces, such as lock chambers, open excavation trenches, culverts, pipes, lofts and cellars in derelict buildings. Particular respiratory hazards in confined spaces include a toxic or explosive atmosphere, lack of oxygen and disturbing dust when moving about dusty areas. Avoid siting plant close to open excavations, as exhaust fumes are heavier than air and can replace the oxygen. A half face mask may provide added protection, but gas monitoring may be required with breathing apparatus available in case of an emergency.

10 **Exhaust fumes from plant and equipment**
The exhaust fumes from static plant could affect volunteers working nearby. Plant and equipment should be sited so that the exhaust is directed away from the work area. You should consider your neighbours and make sure you will not create a nuisance with the exhaust fumes.

11 **Solvent fumes**
Fumes given off from solvent based substances can affect volunteers. Plan to use non-solvent based substances, such as water-based paints where possible. When using these substances in an enclosed space ensure there is adequate ventilation. A half face mask will provide added protection to the volunteer doing the work.

12 **Bonfires**
Bonfires must not be used to burn hazardous substances. Often vegetation from scrub bashing is burned on site. The smoke from a bonfire can be a nuisance and may contain hazardous particles which can be inhaled. The siting of a bonfire should take account the proximity of neighbouring properties and weather conditions. A D7 exemption licence must be obtained from the Environment Agency before having a bonfire on site.

Warning signs will alert others to the activities being carried out.

There are other specialist activities that will require their own control measures to protect the operatives and others working around them.

These include:

1 Welding and gas cutting.

2 Grit blasting.

3 Asbestos removal.

4 Grouting.

5 Working in roof spaces.

It is likely that these activities will be carried out by specialist contractors.

USEFUL RESOURCES:

Construction dust partnership

HSE table of exposure limits, EH40

HSE information sheet Construction dust CIS36

HSE guide for control of exposure to silica dust

Sign up to read the full Practical Restoration Handbook and supporting resources here:
waterways.org.uk/practicalrestorationhandbook

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INLAND WATERWAYS ASSOCIATION

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