



## Health Risk Control – Controlling Exposure to Hazardous Substances

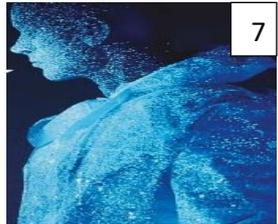
This OSHKE document provides information on key learning points to help you look after your health at work. **Dust, fume, mist, and vapour.**

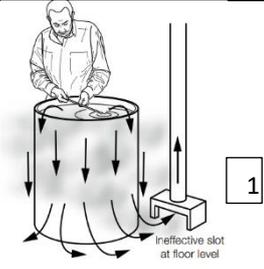
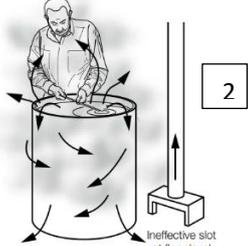
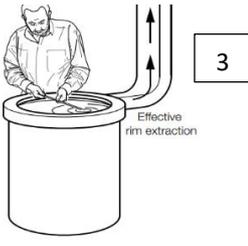
Activity	Learning points	Further information
<b>Dust generation and control</b>		
<p>1</p> 	<p><b>Health damaging dusts (e.g. wood, glass wool, asbestos) are made up of tiny particles, invisible to our naked eyes.</b> They are nearly 10 to 30 times smaller than the diameter of a  single hair strand (see figure on the side).</p> <p>The amount and type of dust (e.g. wood, silica, flour) generated will depend on the material being worked-on, work activity and the machine being used.</p>	<p><b>Picture 2:</b> the operator is using a power sander with on-tool extraction. The dust collection bag is held on the back of the operator. You will note that a haze is absent in picture 2, because of dust extraction (compare with picture 1).</p>
<p>2</p> 	<p><b>Hazards:</b> Dusts are irritant to the respiratory system and the skin. Most are astmagens and carcinogens.</p>	<p>Note: In circumstances like these, where dust (e.g. wood, silica, rubber) is to be extracted using on-tool devices, HSE guidance recommends high efficiency <b>M or H type Portable vacuum cleaners</b>. <b>Photos 3, 4 and 5</b> show three examples of vacuum cleaners and applications.</p>
<p>3</p> 	<p><b>Risks:</b> Exposure to dusts can cause respiratory irritation and asthma. Many can cause cancer. Exposed skin can suffer from irritation and dermatitis.</p>	<p><b>Photo 5:</b> This vacuum cleaner has not been maintained (fine dust coating on the machine and hose). The disc sander's extraction holes are heavily blocked up with dust. The observation suggests that more than one tool is connected to the cleaner (see Y-piece), making the suction power inefficient to control dust.</p>
<p>4</p> 	<p><b>Picture 1</b> shows a person preparing an area of wood floor before applying varnish. He is using a power sander.</p> <p><b>Questions</b></p> <p>1. What is the main exposure control measure which is absent to minimise wood dust in air? <b>On-tool dust extraction.</b></p>	<p><b>Dust created by handheld power-tools should be adequately controlled.</b></p>
<p>5</p> 	<p>2. What is the name of the mask worn by the operator? - <b>Disposable mask (respirator).</b></p> <p>3. What type of filter and the filtering effectiveness is needed from the mask? - <b>Dust filter and high efficiency type. Assigned Protection Factor: 20.</b></p>	<p><b>Filters and filter bags should be looked after.</b> You can see that the filter bag on the left is clogged up with fine dust. This would reduce the extraction power of the vacuum cleaner.</p> <div style="display: flex; justify-content: space-around;">   </div>

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<p><b>Dust generation and control</b></p>   	<p><b>Don't use broom or compressed air lines to clear hazardous dusts.</b> (wood, silica, cement, welding, flour, rubber and foundry dusts). Using these methods will disturb the dust and allow it to become airborne and inhaled by workers.</p> <p><b>Picture 2</b> shows that large quantities of dust can be created (see the green scale) by broom sweeping, as demonstrated by HSE.</p> <p><b>Picture 3</b> shows fine dust being created during compressed air cleaning. This fine dust was made visible using a powerful light and a black background (imagine, sunlight coming through fine holes in a room and making fine dusts visible).</p>	<p>Where it is reasonably practical, extract the dust at the point of creation. For example, close to portable saws, sanders, table sanding machines and so on.</p> <p>Where there is a need to clear dust from surfaces, use a suitable vacuum cleaner (HSE guidance recommends high efficiency M or H type Portable vacuum cleaners).</p> <p>Alternatively, use an extractor hose attached to a factory extraction system.</p> <p>It is easy to use compressed air line to blow dust. But it is an unacceptable practice. Regulators will take a hard line because operators' will be exposed to significant amount of dust and in the long term, they can suffer serious ill-health effects.</p>
 	<p><b>Dust should be extracted or controlled at the point (or very close) where it is being generated.</b></p> <p>You can find dust specific (e.g. construction, foundry, rubber) control measures in HSE's task specific COSHH Essential DIRECT ADVICE sheets. <a href="https://www.hse.gov.uk/coshh-essentials/">COSHH e-tool - COSHH Essentials (hse.gov.uk)</a></p>	<p>On the top picture, top safety guard (for the circular saw) does not have an integrated dust extraction. Because of this, lots of unextracted dust can remain in the breathing zone of the operator and surfaces (see picture). Note: this machine has extraction at the lower end of the machine (see marked LEV). The designer may not have understood enough about extraction system design.</p> <p>Picture below shows extraction. It has been integrated onto the top guard.</p>
	<p><b>Dust collection area should be kept clean.</b></p> <p>When changing bags or emptying bags (including those fitted inside dustbins), operators should wear high efficiency (type P3 filter) dust masks or similar.</p>	<p>Fine dust gets deep inside the lungs to cause ill-health.</p> <p>The dust collection station shown in the picture is clean and tidy. Observe the cleanness of the surrounding walls and the floor area.</p>

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<p><b>Dust generation and control</b></p>  <p>silica dust</p> <p>1</p>	<p><b>The daily amount of legally allowed silica dust exposure is very tiny.</b> HSE has compared this amount of dust against the size of a penny coin.</p> <p><b>Dangerous levels of silica dust are created during many construction activities.</b> For example, when cutting and shaping paving stones, scabbling, grinding, chasing, drilling, coring, blasting surfaces, and clearing rubble.</p>	<p>Crystalline silica dust that gets deep inside the lungs is very tiny. It isn't easily cleared out of the lungs.</p> <p>Daily exposures would mount up and collect in the lungs and damage its tissues to cause disease, (e.g. silicosis and lung cancer.) That is why exposure should be adequately controlled.</p>
 <p>2</p>  <p>3</p>	<p><b>When dry stone cutting, just a respirator is not OK, according to HSE (Picture 2).</b> Just because, this operator is wearing a respirator, it isn't an excuse to do dry cutting and create dust in the breathing zone, and around the skin. Note: The way the job is being done could cause back pain and muscular damage to the operator.</p>	<p>According to HSE guidance (indg463) dust creating activities involving portable tools should be under on-tool extraction or wet-cutting (see picture 3). Other suitable control measures may be used, see HSE activity specific COSHH Essentials guidance.</p> <p>Respirators provided should have high efficiency dust filters (P3 type).</p>
	<p><b>Extraction and dry cutting can be a way to minimise dust exposure.</b></p>	<p>Although extraction is used, the operator should wear a high efficiency dust mask.</p> <p>Silica dust contamination of street clothing and PPE should be avoided.</p>
 	<p><b>Integrated extraction at source.</b> Holes are being being drilled with portable vacuum extraction.</p> <p>Some people are calling silica as the next asbestos.</p> <p><b>Take care. Work safe. Stay healthy.</b></p>	<p>The methods used helps to reduce dust exposure. However, the Construction, Design and Management Regulations will ask, did the designers and others consider factory drilled blocks. Where practical prefabs with holes should be installed in new builds.</p> <p>The exposure control methods shown may be a way to do few holes or work undertaken in existing buildings.</p>

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<p><b>Fume generation and control</b></p>    	<p><b>Fume is vaporised solid that has condensed in air.</b> Fume clouds tend to be dense and are partially visible. Fume and smoke are generally more visible (because they stick together) than equivalent concentrations of dust.</p> <p><b>Hazards:</b> Metal fume, in general, is a respiratory irritant, allergens and can cause metal fume fever. Many types are carcinogens.</p> <p><b>Risks:</b> Exposure to metal fume can cause metal fume fever, severe respiratory disease including asthma and obstructed lung problems. In the long term (years), many types of fumes can cause lung cancer.</p> <p><b>Workers exposure to fume should be adequately controlled.</b></p>	<p>Commonly encountered fume contamination includes from welding, soldering, diesel engines, rubber, plastic and foundry processes.</p> <p><b>Picture 1</b> shows welding fume being generated without any fume extraction at the point of generation (or close).</p> <p><b>Picture 2</b> shows soldering fume being generated without any fume extraction at the point of generation (or close).</p> <p><b>Picture 3</b> shows plastic fume from a process being extracted by an enclosed extraction hood system.</p> <p><b>Picture 4</b> shows metal fume in air from a foundry melting/casting process. Worker's breathing zone is filled with fume. There is no extraction and the worker (face area masked out) did not wear any respiratory protection.</p>
   	<p><b>Do not weld without adequate protection.</b></p> <p><b>Always work within the fume capture zone of a hood.</b> In picture 2, it is marked with yellow wire for demonstration purpose. If the work is undertaken outside the capture zone, fume will not be extracted properly, leading to workers being exposed.</p> <p>Your employer must ensure they have determined the capture zone of their LEV hoods in use and trained you on how to work within the capture zone.</p> <p><b>Other ways of controlling exposure to welding fume: using on-torch extraction or a down draught welding bench.</b></p> <p>Remember, you should also use other protection measures as explained above in the context of picture 1.</p>	<p>In picture 1, the welder is using a movable capture hood and the work is done within its extraction power (known as capture zone). The welder is wearing face protection, eye protection for UV, respiratory protection, welding gloves to protect hands and fire-retardant coveralls.</p> <p>You can find fume specific (e.g. foundry, rubber, soldering) control measures in HSE's task specific COSHH Essential DIRECT ADVICE sheets. <a href="https://www.hse.gov.uk/coshh-essentials/">COSHH e-tool - COSHH Essentials (hse.gov.uk)</a></p>

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<p data-bbox="204 237 520 264"><b>Mist generation and control</b></p> <div data-bbox="261 293 539 488">  </div> <div data-bbox="261 555 539 763">  </div> <div data-bbox="261 797 549 992">  </div> <div data-bbox="261 1025 549 1240">  </div> <div data-bbox="261 1274 544 1469">  </div> <div data-bbox="261 1503 544 1720">  </div> <div data-bbox="261 1783 539 2007">  </div>	<p data-bbox="619 271 1027 472"><b>Mist is made of fine liquid droplets in air. They can be on their own or mixed with solids dissolved in them</b>, for example paints, pesticides, cooling oils on their own or mixed with water.</p> <p data-bbox="619 512 1027 819">Mist is process generated. It is generated in a variety of work and work activity situations. For example, metal machining and the use of cooling fluids (picture 1), paint spraying (pictures 2 and 3), metal plating (picture 4), pesticide spraying (picture 5). From a cooling tower water (picture 6).</p> <p data-bbox="619 860 1027 1032">These pictures show that <b>mist when generated can have significant projectile power</b>, so the design of exposure control measures will have to match the process.</p> <p data-bbox="619 1072 1027 1267"><b>A volatile solvent mist will go on to generate vapours.</b> For example, mist created during activities shown in pictures 3 and 4 will create organic solvent vapours, if the paints are solvent based.</p> <p data-bbox="619 1308 1027 1581"><b>Hazards:</b> Mist, generated when using hazardous substances, are respiratory irritants. In addition, substance specific mist will have other health hazards and health risks. For example, organic solvent-based mist can be toxic to lungs, kidney and nervous system.</p> <p data-bbox="619 1621 1027 1794"><b>Risks:</b> The health risks from exposure to mist will depend on the composition of the mist. Some can cause lung cancer and others can cause asthma.</p> <p data-bbox="619 1834 1027 1962">You need to look at HSE process specific guidance to know more about mist specific hazards, risks and control measures.</p>	<div data-bbox="1050 300 1481 461">  </div> <p data-bbox="1050 501 1481 763">Some mist generating sources can become contaminated with other unwanted materials like swarf, tramp oil (see pictures above), food waste, bacteria and animal waste. These problems are commonly associated with metal working fluids and cooling tower water operations.</p> <p data-bbox="1050 804 1481 1223">HSE used a dummy (picture 7) to show mist in air can quickly contaminate workers during work activities generating mist. This picture shows, why it is necessary to control and extract mist, (fume, dust and vapour) close to where they are being generated. If they aren't adequately controlled, workers will become exposed to hazardous substances and can suffer from ill-health effects resulting from the exposure.</p> <p data-bbox="1050 1263 1481 1424">You can find mist generation activity specific control measures in HSE's task specific COSHH Essential DIRECT ADVICE sheets. <a href="https://www.hse.gov.uk/coshh-essentials">COSHH e-tool - COSHH Essentials (hse.gov.uk)</a></p> <p data-bbox="1050 1503 1481 1805">In picture 4, you see mist close to the liquid surface, after that it vaporises quickly and become invisible. In Picture 5, the mist generated is so fine and in an open area, it is not visible. It can be made visible by shing a powerful light with a black background the the area. You have seen the effect with compressed air line cleaning.</p>

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<p data-bbox="204 237 552 264"><b>Vapour generation and control</b></p>  <p data-bbox="344 546 448 566"><b>Misconception</b></p>   <p data-bbox="336 1196 456 1216"><b>Control solution</b></p>	<p data-bbox="619 271 1027 472"><b>The gaseous phase of a substance which is normally a liquid or solid at room temperature.</b> Behaves like a gas. Usually invisible. At very high concentrations, a vapour-laden cloud may just be visible.</p> <p data-bbox="619 510 1007 611"><b>Examples include</b> styrene, petrol, acetone, mercury and iodine (solid at room temperature).</p> <p data-bbox="619 651 1027 786"><b>Hazards:</b> Solvents are irritants, harmful and toxic (but the specificity of hazards can vary from one solvent another).</p> <p data-bbox="619 824 1007 958"><b>Risks:</b> Some of the short-term hazards are irritation to the eyes, lungs and skin. Headaches, nausea, dizziness, and light headedness.</p> <p data-bbox="619 999 1023 1200">Some of the long terms effects (but the effects can vary from one solvent another) include lung cancer, nervous system damage and health effects to other parts of the body such as kidney and liver.</p> <p data-bbox="619 1240 999 1375"><b>Law requires that exposure to substances hazardous to health must be prevented or adequately controlled.</b></p>	<p data-bbox="1050 271 1493 472">Many employers and LEV designers misundstand the behaviour of solvent vapours. In this example (picture 1), the misconception was that solvent vapours are heavier than air so it will sink to the floor.</p> <p data-bbox="1050 510 1417 539">The reality is shown on picture 2.</p> <p data-bbox="1050 580 1485 815">And the correct design in this case is to install rim extraction ring ventilation as shown in picture 3. In this case, vapour rising out of the tak is extracted at the lip of the tank and not allowed to escape into the breathing zone of the operator.</p> <p data-bbox="1050 855 1493 990">Many work activities can involve the use of solvent based products. They can create the potentail for exposure to different types of solvent vapours.</p> <p data-bbox="1050 1030 1485 1232">As solvents can be hazardous to health, always check out the product safety data sheets and look at HSE process specific guidance sheets to know more about solvent specific hazards, risks and exposure controls.</p>
  	<p data-bbox="619 1384 1023 1518"><b>Suitable down draught extraction is one way for controlling solvent vapour exposure.</b> (e.g. NDT testing station)</p> <p data-bbox="619 1626 1015 1727"><b>Using sealed machines for controlling exposure.</b> (e.g. cleaning metal parts, cloths etc).</p> <p data-bbox="619 1798 967 1865"><b>Controlled paint stripping</b> (e.g. doors and furniture)</p> <p data-bbox="619 1906 1007 2031"><b>COSHH regulations demand that exposure to hazardous substances must be prevented or adequately controlled.</b></p>	<p data-bbox="1050 1384 1485 1653">Examples of work activities include, using dye pnertraion products for crack testing (NDT), vapour degreasing, paint stripping, paint spraying, printing, water proofing cloths, printing on cloths, using adhesives in many activities including footwear making/repair.</p>

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 <p>Mixing in open and using solvents</p>	<p><b>In this page, a number of incorrect exposure control measures are shown to get across the point that controls must be adequate and suitable. They must be designed, used and maintained correctly.</b></p>	 <p>A 90 degree bend on the flexible duct. It means it will severely slow down the dust transport velocity and dust will start to settle in the area. Note, home made repairs.</p>
 <p>Cleaning with solvents, no exposure control – inhalation and skin</p>	 <p>A half mask respirator for protection against dust is stored in a contaminated area and the facepiece face-seal area is contaminated</p>	 <p>Extractor duct not connected to the machine. Expected to extract dust as fitted by a DIY LEV design</p>
 <p>Dispensing solvents using wateringcan. Solvent is dripping on to floor and the container</p>	 <p>Shows dust contamination inside face mask, and the valve seating is badly contaminated causing leaky valve leading to exposure</p>	 <p>A big hole in a vacuum cleaner dust collection bag used by a worker with a sanding machine</p>
 <p>Using hands to make balls of rubber coating mixed in solvents. Use solvent in the red can for cleaning hands. Movable hood is far away from the operators hands area, anycase useless for an unacceptable workactivity.</p>	 <p>Bottom strap of the respirator is not worn; top strap is twisted. Ear plug not fully inserted to receive adequate protection</p>	 <p>Wood dust accumulation on a LEV duct. It indicates ineffective dust control measures</p>
 <p>Cleaning printing ink from the mixing bucket on an open bench. Gloves are contaminated</p>	 <p>Respirator hung at the face of the extraction booth. Filter fitted to the booth is heavily contaminated – will reduce extraction effectiveness and whereby reduced protection for workers. Signs showing lack of supervision and maintenance</p>	 <p>A twisted LEV ducting causing air/dust flow restrictions.</p>
 <p>Contamination of surfaces with solvent based systems</p>	 <p>Inside of the glove is contaminated with solvent based dyes</p>	 <p>A metal working fluid heavily contaminated with tramp oil and other contamination. It indicates problems. When the fluid is circulated during machining, the mist created by the activity can cause workers to inhale oil and other rubbish contaminated metal working fluid mist</p>