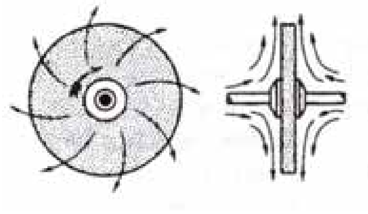
Introduction

To effectively control exposure, local exhaust ventilation (LEV) hoods must be designed to match the way processes and sources emit airborne contaminant clouds. It follows that to apply a LEV effectively, you must understand processes and sources. The following diagrams and video clips illustrate common processes and how they emit
 airborne contaminant clouds.

Process and source descriptions for HSE 'control' website

Process	Examples	Creation mechanism(s) and description, video clips voice-over	Possible modifications/ controls
Introduction Most common processes and sources are described. Some occur individually and others overlap, for instance, air-displacement may occur when a person handles and stack objects. For each process examples are given, the mechanism(s) creating air movement are described and some possible process modifications and controls are listed. For each process illustrated with a video-clip there's a voiceover script.			

Process	Examples	Creation mechanism(s) and description, video clips voice-over	Possible modifications/ controls
a. Rotating tools and parts	Orbital, belt and disc sanders. Disc cutters. Circular saws and routers. Lathes. Drills Abrasive wheels and polishers	Rotating motion creates a fan effect. Air movement created may be a unidirectional air-jet if the rotating part is partially enclosed in, for instance, a guard (see Figure Y in HSG 258). Or the source air may flow outwards radially in the plane of rotation (see Figure X in 258)  **Voice over: (video-clip of 'naked' saw blade plus blade with LEV hood (guard). Air movement made visible with smoke.** The rotating circular saw blade acts as a crude fan. It draws air in along the axes of saw-blade rotation and its spinning motion throws the air outwards. The flow of air induced by the spinning saw blade is directed or shaped by the saw table. Two distinct air-jets are created in the plane of the saw blade. One is wide and flows sideways and upwards in the direction of rotation towards where the saw operator would normally be standing. The other is much narrower and flows straight up from the back of the rotating saw blade. When the saw-blade guard is added the vertical air-jet is contained and the wide air jet is re-directed, escaping as two jets flowing towards the saw operator. In this example the local exhaust ventilation system (LEV) hood isn't big enough and the airflow into the current hood is too low. The air-jets created by the fan-action of the saw blade overwhelm the air-flow created by the LEV system. The saw hood (guard) is filled with air by the fan-action of the saw-blade faster than it is emptied by the LEV system. The solution is to use a bigger LEV hood to cover the saw-blade and extract more air.	•Reduce rotational speed. •Enclose. •Strip off the "boundary layer" of still air moving with the rotating disc •Closely applied Low Volume High Velocity (LVHV) capturing hood •Water suppression.
b. Hot (and cold) processes	Furnaces. Casting. Soldering, brazing and welding.	**Diagram only (no video)** Hot process and source; releases hot contaminant cloud and heats air locally. Plume rises and expands by entraining workplace air . Cold process and source; Same mechanisms as for 'hot' but, in this case, the plume sinks. To apply LEV control the approximate volume and flow rate of hot/cold	Reduce temperature. Enclose process. Inhibit convection and entrainment

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	Pouring liquid nitrogen	air can be calculated or measured using smoke to make the plume rise/fall visible.	of workroom air
c. Free falling, solids, liquids and powders	Falling liquid, powder or solid material. Conveyor transfer of powders/solids.	Falling material induces a downward flow of air. If the material is a powder there will be some shearing off of powder-laden air at the edges of the falling stream. **Voice over (applies to (c) and (d):** Falling powder onto a flat surface (from two heights) and into a bin. As the stream of powder falls. It induces a downward flow of air. If the powder loans on a flat surface. It splashes' is outwards. The induced downward flow of air carries powder made airborne by the splash away from the site of impact. The greater the height of fall, the higher the terminal velocity of the falling column of powder, and the greater the amount of induced airflow. This in turn increases the degree of splash and outward flow of the airborne dust cloud. Depending upon where the material lands the induced downward flow of air may flow outward in the form of a 'splash' or, if the fall is into a container, the airflow will induce upward air displacement.	Reduce height of fall. Enclose the falling material (reduces air entrainment).. Seal all gaps in enclosure. Apply LEV to enclosure.
d. Displacement	Liquids, powders or solids being transferred into a container	Materials will displace their own volume of air out of the container. If they have fallen from a height, the induced airflow will displace further air from the container.	Minimise open area of container top. Apply LEV to extract displaced air
e. Spraying and blasting	Paint spraying. Abrasive blasting	Compressed air pressure is used to induce and propel liquids or solid particles against surfaces to be painted or abraded. In the process the compressed air-jet and the cone of moving liquid/solid particles induce further air movement and create a cone shaped jet. (Similar though differently shaped sources are produced by gas or liquid escaping under pressure) The 'throw' of a paint spray gun can be over 12 metres and the initial	Reduce air pressure. Enclose the process. Apply by less 'energetic' means e.g. brushing or

Process	Examples	Creation mechanism(s) and description, video clips voice-over	Possible modifications/ controls
		velocity, immediately in front of the air-cap can be >100 metres/second. **Voice over:** movement of spray gun compressed air and the airflow it induces is made visible by injecting smoke into the moving air. The narrow airjet leaves the spray gun at over 100 metres per second. It travels rapidly away from the spray gun. The total 'throw' of a spray gun jet may be over 12 metres or more. It is an energetic and difficult to control process.	rollering
f. Fracturing solids	Rock crushing (e.g. primary and secondary quarry rock crushing) Recycling of road surfaces including concrete via transportable crushers. Splitting (e.g. in slate making)	Pressure leads to 'brittle' fracture of solid with very local but explosive release of dust-laden air (dust cloud). Movement of material may create airflow, increase dust cloud size and give it directional flow e.g. slate splitting **Diagram only (no video)** fracturing solids, such as stone, or concrete, releases chips and fine dust into the air. The chips fall down and the fine dust flows away from the fracture site, suspended in the air.	Enclose the process. Keep rock, stone etc wet/damp
g. Impact and vibration	Powder covered sacks landing on a conveyor. Machinery vibration re-suspending settled dust	Settled dust or split powder on a surface is re-suspended or propelled into the air by the physical impact or vibration applied to the surface. Badly dust contaminated clothing can behave in the same way. Compressed air aimed at a surface to remove debris (e.g. swarf) can have a similar effect. Once re-suspended where the dust-laden air moves to depends upon workroom air movement. **Voice over:** Settled dust or spilt powder can be propelled into the air from a contaminated surface and propelled into the air by impact or vibration. The amount of airborne dust release released will depend on	Eliminate or minimise: impact and/or vibration and/or surface contamination.

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		the degree of surface contamination, the nature of the dust, and the energy (frequency and amplitude) of the shock or vibration applied to the surface.	
h. Compaction	Crushing of waste material. Rolling up used sacks	The compaction action squeezes air out of the material creating dust/vapour clouds. The direction of travel and size/shape of the flowing contaminant cloud will depend on the shape and size of the material being compacted. **Diagram only (no video)** compaction is similar to displacement and the mechanism by which airborne contaminant clouds are created are the same. As material, contaminated with powder or liquid, is compressed air is driven out of spaces within the material. The crushing or squeezing action, and in some case cases, induced heating, releases contaminant and air squeezed out by the compaction flows from the material as a contaminant cloud.	Minimise waste. Enclose compactor and apply extract ventilation
i. Handling	Sorting. Stacking. Carrying	Mechanisms will depend on what's handled. If covered in settled dust this may be re-suspended. If objects are stacked air-displacement may lead to further re-suspension. Carrying of dusty objects may lead to direct contamination of work-clothing and skin. **Diagram only (no video)** The mechanisms that lead to creation of airborne contaminant clouds depend on how objects are handled and the contaminants involved. Potential mechanisms will include impact and vibration, displacement and direct skin contact.	▪ Clean objects before handling ▪ Use handling aids ▪ Apply ventilation controls ▪ Use PPE
j. Machining	Milling Turning	Mist of metalworking fluid created by rotating and/or reciprocating parts Impingement of fluid jet on machining mechanism as it indexes tools. Condensed fume if material being worked gets sufficiently hot. **Diagram only (no video)** and this can be created when metalworking fluid comes into contact with rotating or reciprocating parts. The mist is created mechanically in this case. Where tools and components get hot	▪ Increase fluid flow to increase cooling ▪ Stop fluid flow during tool indexing ▪ Full enclosure

Process	Examples	Creation mechanism(s) and description, video clips voice-over	Possible modifications/ controls
		fluid may boil and condense creating fine liquid fume. Where rotating parts are involved. The fan effect may propel the contaminant cloud away from the process as a directional jet.	with extraction
k. Abrasion	Sanding Grinding Polishing Fettling	Rubbing away a surface by friction. Surface, and abrasive (to an extent), breaks up into particles. Fine particles become airborne. **Diagram only (no video)** most abrasion is deliberate. And abrasive is applied to a surface and rubs or abrades it. The action of the rough surface of the abrasive creates particles, which become airborne.	▪ For powered hand-held tools built in capturing LVHV. ▪ Grinding and polishing – a closely applied receiving LEV hood ▪ A partial LEV enclosure (booth)
l. Sweeping	Sweeping up stone, wood or flour dust	Mechanical action of the brush creates an airborne dust cloud with some air-flow in the direction of brushing. **Diagram only (no video – might be video)** Sweeping of settled dust or spilt powder will disturb fine particles and make them airborne. The sweeping action will also create directional air movement and turbulence. The contaminant particle cloud created will flow into the sweeper's breathing zone and spread to other parts of the workplace.	Minimise process leakage. ▪ Use another method of cleaning such as vacuuming or damp brushing