**COSHH Guidance Notes on Risk Assessment**

A COSHH risk assessment must be conducted before you commence work which could expose you to substances hazardous to health.

The aim of the COSHH risk assessment is:

* To identify the substances you are going to use in a particular procedure / process / experiment
* To determine which of those substances are hazardous to health
* To determine how hose substances are hazardous and what effects they could have on your health or others’ health
* To estimate the risks of exposure to these substances when you use them in the procedure / process / experiment
* To decide the precautionary measures you must take to either prevent exposure or adequately control the risk of exposure.

The precautionary measure must be implemented prior to work commencing.

**Separate risk assessments are not needed for each substance used in a particular procedure / process / experiment.**

Group (generic) risk assessments can be used satisfactorily where similar substances are used in similar jobs e.g. handling solvents in HPLC work, handling detergents in automatic dishwashers etc. In addition, COSHH risk assessments can be sued as a basis for drafting Safe / Standard Operating Procedures (SOPs).

The COSHH risk assessment form is subdivided into 7 sections. Guidance on completing these sections is given below:

**Section 1: Project details**

Provide a full description of the work area including locality (indoors / outdoors), room / laboratory number, building name, PI etc. A detailed description of the particular procedure / process / reaction should also be provided including:

* The substances to be used
* The properties of the substances (gas, vapour, volatile liquid, dust)
* The quantities of substances to be used
* How the substances are to be used (contained, released, sprayed, mixed, heated or ground into powder)

**Section 2: Hazard Summary Section**

This is a quick reference as to how hazardous the procedure / process / experiment is. Indicate the hazardous properties by placing a tick in the appropriate boxes.

**Section 3: Hazardous Substances Information**

List all the substances you are going to use in the procedure / process / reaction along with their hazard classification, physical form, routes of exposure and any workplace exposure limits (WELs) that are assigned. This information can be found on the Manufacturer’s Safety Data Sheet, product labels etc.

If none of the substances to be used are hazardous to health, the risk assessment is complete at this stage.

The ***hazard classifications*** include:

* Health Hazard
* Toxic
* Corrosive
* Irritant
* Flammable
* Oxidising
* Explosive
* Compressed Gas
* Dangerous for the Environment

Also include any hazard statements associated with the substances being used. A full list of Hazard and Precautionary statements can be found in Appendix 1.

***Physical forms*** include:

* Liquid
* Powder
* Gas
* Dust
* Vapour

***Routes of exposure***:

Substances can enter the body by four main routes:

* Inhalation – breathing in gases, vapours, fumes, dusts, aerosols, fibres)
* Ingestion – accidental swallowing of solids / liquids
* Absorption – direct uptake of gases, liquids, vapours through unbroken / broken skin
* Injection – misuse of hypodermic needles

This is a vital part of the risk assessment as the formulation of effective control measures is dependent on preventing entry of substances into the body.

Inhalation is considered to be the major route of entry into the body, therefore consideration must be given to processes that could generate gases, vapours, aerosols, fumes, dusts and fibres.

Substances used which can be absorbed through the intact skin should be clearly identified and the possibility of skin contact in the process carefully evaluated. Such substances are identified in EH40 with a skin ‘SK’ notation. A list of substances that can be absorbed through the skin can be form in Appendix 2.

Finally, it should be verified that the likelihood of entry by ingestion and direct injection has been minimised. In the work environment, the risk of exposure from these routes is usually controlled by good working practices. For example, eating, drinking, smoking and the application of cosmetics should not be permitted in the workplace to prevent accidental ingestion. Similarly, cuts and abrasions should be covered with waterproof dressings to prevent invasion.

***Workplace Exposure Limits (WELs):***

The COSHH Regulations reference Workplace Exposure Limits, a full list of which can be found in EH40/2005 Workplace Exposure Limits (free to download from the HSE website), or Section 8 of the Safety Data Sheet. WELs are maximum concentrations of airborne substances averaged over a reference period, to which employees may be exposed by inhalation. These are time-weighted averages of either long term (8 hours) or short term (15 minutes). If proper control measures are in place, no employee should be exposed to above the WEL for the substance in question.

***Hazards produced during / after reaction / experiment:***

In this section, identify any hazardous products that are produced both during and after the reaction / experiment. The hazardous properties of these substances would also need to be considered as part of the risk assessment process.

***How often will this work activity be carried out / How long will the process / work activity last:***

Consider how often the process will be carried out i.e. once, once per day, once per week etc. Consider if the process will take minutes, hours, days, weeks etc. to perform. Also consider if exposure to substances hazardous to health will be continuous or intermittent when carrying out this process.

Consider the properties of the substances hazardous to health being used:

* Dustiness / Volatility
* Quantities used (μg, mg, kg or μl, ml ,l)
* Way in which the substances are used (heated, vaporised, volatilised etc.)
* Degree of containment / protection provided by typical precautionary measures chosen in Section 4.

***Who might be at risk:***

Consider others not directly involved in the work who may be at risk from exposure. Are the risks adequately controlled for these people in local rules or standard operating procedures.

In certain situations a ‘permit-to-work’ may be required. For example, repair of a fume cupboard would require a permit-to-work to ensure that it was fully decontaminated and could not be used while the contractors were carrying out repairs.

***Assessment of risk PRIOR to the use of controls***

The level of risk before any controls are put in place must be recorded. The risk matrix below is used to give an indication of the level of risk associated with the process / procedure / experiment to be carried out.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Risk Likelihood** | | | |
| **Hazard Severity** | | Unlikely (1) | Possible (2) | Likely (3) | Very Likely (4) |
| Minor (1) | | **1** | **2** | **3** | **4** |
| Moderate (2) | | **2** | **4** | **6** | **8** |
| Serious (3) | | **3** | **6** | **9** | **12** |
| Very Serious (4) | | **4** | **8** | **12** | **16** |
| Extreme (5) | | **5** | **10** | **15** | **20** |

|  |  |
| --- | --- |
|  | **Risk Rating** |
| Low | **(1-5)** |
| Medium | **(6)** |
| High | **(8-10)** |
| Very High | **(12-20)** |

**Section 4: Controls**

***Physical or Engineering controls*:**

Exposure to substances hazardous to health should be **prevented**, as s first priority.

Therefore, firstly consider if you can prevent exposure to the substances you have listed by using safer procedures / processes / experiments or by substitution of substances (e.g. toluene for benzene, water-based paints for solvent based one) or by using the substances in a safer form (e.g. pellets instead of powders, ready made-up solutions).

Where the procedure involves suspected carcinogens or mutagens, every effort must be made to substitute a non-carcinogenic on non-mutagenic alternative.

If exposure cannot be prevented, consider the most effective control measures required to adequately control exposure that are proportionate to the risk e.g.

* Total containment – Glove Box, Class III Biological Safety Cabinet, Pipelines and Vessels
* Partial containment – Fume cupboard, Paint-spray booths, Class I and II Biological Safety Cabinets
* Local Exhaust Ventilation (LEVs) – Fume canopies
* Dilution Ventilation - Open doors, windows
* Others - Personal Protective Equipment (PPE) such as gloves, aprons

Control of exposure by inhalation is considered adequate, only if WELs for the substances involved are not exceeded. Guidance for estimating the WEL can be found on the University Safety Service website or Appendix 3.

***Administrative controls:***

Administrative controls limit workers’ exposures by scheduling shorter work times in contaminant areas or by implementing other ‘rules’. Theses controls measures have many limitations because the hazard itself is not actually removed or reduced.

When necessary, methods of administrative control include:

* Scheduling maintenance and other high exposure operations for times when few workers are present;
* Using job-rotation schedules that limit the amount of time an individual workers is exposed to a substance;

Work practices are also a form of administrative controls. In most workplaces, even if there are well designed and well maintained engineering controls present, safe work practices are very important. Some elements of safe work practices include:

* Developing and implementing standard operating procedures;
* Training and education of employees regarding the operating procedures as well as other necessary workplace training;
* Establishing and maintaining good housekeeping programs;
* Keeping equipment well maintained;
* Preparing and training for emergency response for incidents such as spills, fire or injury.

***Out of hours controls:***

If the process / procedure / experiment is to run out of normal working hours, are there any specific control measures required? If so, they should be recorded in this section.

***Personal Protective Equipment*:**

PPE must only be considered as a last resort and must be used in **addition** to all other control measures if the combination of all control measures fail to achieve adequate control of exposure.

Types of PPE available:

* Laboratory coats
* Apron
* Safety footwear
* Gloves
* Glasses / goggles / face shields
* Respiratory protective equipment
* Heating protection

Advice on the selection and use of PPE is available from the University Safety Service. Details on the fit testing of respiratory protective equipment is also available from the University Safety Service.

***Storage requirements:***

Section 7 of the Safety Data Sheet provides information on the safe handling and storage of the substances. This document should be referenced and any relevant information regarding storage, recorded in this section.

***Disposal procedures:***

Water miscible solvents and other substances may be flushed to drain but only in very small quantities (< 100ml at one disposal).

Small quantities of vapours / gases / aerosols may be discharged into a fume cupboard for aerial dispersion. Similarly, small quantities of volatile liquids may be allowed to evaporate to atmosphere within a fume cupboards.

In general, most substances hazardous to health will be disposed of by arrangement with the University Safety Service.

**Is exposure monitoring required?**

Exposure monitoring provides assurance on the adequacy of your controls. It has nothing to do with the state of a workers health.

Exposure monitoring should be conducted for processes / procedures / experiments which involve large quantities or airborne contaminants and which are carried out frequently over long periods of time. It is also necessary when failure or deterioration of the control measures could result in a serious health effect, either due to the toxicity of the substance or the extent of potential exposure, or both.

**Is health surveillance required?**

Health surveillance is necessary if an individual is exposed to one of the substances and is engaged in one of the processes listed in the Schedule 6 of the COSHH Regulations.

Health surveillance is appropriate where employees are exposed to carcinogenic and mutagenic substances, unless the risk assessment confirms that exposure is so adequately controlled that there is no reasonable likelihood of an identifiable disease or adverse effect resulting from the exposure or the quantities used are so small that even if control measures fail, the exposure is likely to be insignificant. It is also appropriate when the work involves the use of substances known to cause occupational asthma or severe dermatitis or if there is contact with chrome solution, electrolytes containing chromic acid or chromium salts and other substances which can cause skin cancer.

If the risk assessment indicates that health surveillance is required, then advice on the nature of the health surveillance should be obtained from Occupational Health and appended to the risk assessment.

New, expectant and breast-feeding mothers should also report their condition to their Line Manager / Occupational Health so that the risk assessment can be reviewed and the appropriateness of health surveillance considered / reconsidered.

**Assessment of risk AFTER the application of controls**

The level of risk after controls are put in place must be recorded. The risk matrix below is used to give an indication of the level of risk associated with the process / procedure / experiment to be carried out.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Risk Likelihood** | | | |
| **Hazard Severity** | | Unlikely (1) | Possible (2) | Likely (3) | Very Likely (4) |
| Minor (1) | | **1** | **2** | **3** | **4** |
| Moderate (2) | | **2** | **4** | **6** | **8** |
| Serious (3) | | **3** | **6** | **9** | **12** |
| Very Serious (4) | | **4** | **8** | **12** | **16** |
| Extreme (5) | | **5** | **10** | **15** | **20** |

|  |  |
| --- | --- |
|  | **Risk Rating** |
| Low | **(1-5)** |
| Medium | **(6)** |
| High | **(8-10)** |
| Very High | **(12-20)** |

**Section 5: Emergency Procedures**

**First Aid:**

Section 4 of the Safety Data Sheet provides general advice on what first aid measures to take if the substance is:

* Inhaled
* In contact with skin
* In contact with the eyes
* Swallowed

This information should be recorded on the risk assessment form to ensure that staff and students will be familiar with what steps to take in an emergency / incident situation.

***Spillage:***

Section 6 of the Safety Data Sheet provides the information required for keeping both staff / students and the environment safe when dealing with a spillage. It covers information on:

* Personal precautions, protective equipment and emergency procedures;
* Environmental precautions;
* Methods and materials for containment and clean up.

If you are cleaning up a small chemical spill, ensure that you are familiar with the hazards associated with the materials spilled, have adequate ventilation (open windows, chemical fume hood on) and proper personal protective equipment (gloves, goggles, laboratory coat, respirator) where necessary. Consider all residual chemical and clean up materials as hazardous waste. Place these materials in sealed containers or plastic bags, label and store in a fume hood. Contact the University Safety Service for disposal instructions and pick up.

***Fire:***

Section 5 of the Safety Data Sheet provides information on the most suitable extinguishing media to use on a fire and also highlights if there are any special hazards arising from the substances.

**Section 6: Contacts**

***Contact in the event of an emergency:***

In the event of an emergency, the Project Supervisor / Line Manager and the COSHH Supervisor should be contacted. Their details should be recorded in this section along with any other relevant contact details e.g. School Safety / Biological Safety Officer, University Chemical Safety / Biological Safety Officer.

***Out of hours contact:***

This section should contain the contact details for the responsible person ‘out of hours’.

**Section 7: Approval**

Although the worker may complete the risk assessment, it is the duty of the Project Supervisor / Line Manager to ensure that risk assessments are carried out for all processes / procedures / experiments (under his / her control) which involve substances hazardous to health.

It is the duty of the COSHH Supervisor to ensure that the risk assessment is complete and that the precautionary measures to be taken are adequate to control the risk.

The Assessor, Project Supervisor and COSHH Supervisor should sign and date all COSHH Assessments.

The COSHH risk assessment should be reviewed at a frequency of not more than 3 years for low risk, and annually for high risk. The assessment should be reviewed immediately when there is evidence to suggest it is no longer valid. For example:

* A change in the substances used, including the introduction of a substitute substance;
* A modification made to engineering controls;
* A change to the process or method of work;
* Complaints from workers about defects in the control systems.

Appendix 1 – Hazard and Precautionary Statements

**Appendix 1 – GHS Hazard Statements**

**GHS Physical Hazard Statements**

|  |  |
| --- | --- |
| **Hazard Code** | **Hazard Statement** |
| **H200** | Unstable, explosive |
| **H201** | Explosive, mass explosion hazard |
| **H202** | Explosive, severe projection hazard |
| **H203** | Explosive, fire, blast or projection hazard |
| **H204** | Fire or projection hazard |
| **H205** | May mass explode in fire |
| **H220** | Extremely flammable gas |
| **H221** | Flammable gas |
| **H222** | Extremely flammable aerosol |
| **H223** | Flammable aerosol |
| **H224** | Extremely flammable liquid and vapour |
| **H225** | Highly flammable liquid and vapour |
| **H226** | Flammable liquid and vapour |
| **H227** | Combustible liquid |
| **H228** | Flammable solid |
| **H240** | Heating may cause explosion |
| **H241** | Heating may cause a fire or explosion |
| **H242** | Heating may cause a fire |
| **H250** | Catches fire spontaneously if exposed to air |
| **H251** | Self heating, may catch fire |
| **H252** | Self heating in large quantities, may catch fire |
| **H260** | In contact with water releases flammable gases which may ignite spontaneously |
| **H261** | In contact with water, releases flammable gas |
| **H270** | May cause or intensify fire; oxidiser |
| **H271** | May cause fire or explosion; strong oxidiser |
| **H272** | May intensify fire; oxidiser |
| **H280** | Contains gas under pressure; may explode if heated |
| **H281** | Contains refrigerated gas; may cause cryogenic burns or injury |
| **H290** | May be corrosive to metals |

**GHS Health Hazard Statements**

|  |  |
| --- | --- |
| **Hazard Code** | **Hazard Statement** |
| **H300** | Fatal if swallowed |
| **H301** | Toxic if swallowed |
| **H302** | Harmful if swallowed |
| **H303** | May be harmful if swallowed |
| **H304** | May be fatal if swallowed and enters airways |
| **H305** | May be harmful if swallowed and enters airways |
| **H310** | Fatal in contact with skin |
| **H311** | Toxic in contact with skin |
| **H312** | Harmful in contact with skin |
| **H313** | May be harmful in contact with skin |
| **H314** | Causes severe skin burns and eye damage |
| **H315** | Causes skin irritation |
| **H316** | Causes mild skin irritation |
| **H317** | May cause an allergic skin reaction |
| **H318** | Causes serious eye damage |
| **H319** | Causes serious eye irritation |
| **H320** | Causes eye irritation |
| **H330** | Fatal if inhaled |
| **H331** | Toxic if inhaled |
| **H332** | Harmful if inhaled |
| **H333** | May be harmful if inhaled |
| **H334** | May cause allergy or asthma symptoms or breathing difficulties if inhaled |
| **H335** | May cause respiratory irritation |
| **H336** | May cause drowsiness or dizziness |
| **H340** | May cause genetic defects |
| **H341** | Suspected of causing genetic defects |
| **H350** | May cause cancer |
| **H350I** | May cause cancer by inhalation |
| **H351** | Suspected of causing cancer |
| **H360** | May damage fertility or the unborn child |
| **H360F** | May damage fertility |
| **H360D** | May damage the unborn child |
| **H360FD** | May damage fertility and the unborn child |
| **H360Fd** | May damage fertility; Suspected of damaging unborn child |
| **H360Df** | May damage the unborn child; Suspected of damaging fertility |
| **H361** | Suspected of damaging fertility or the unborn child |
| **H361f** | Suspected of damaging fertility |
| **H361d** | Suspected of damaging the unborn child |
| **H361fd** | Suspected of damaging fertility; Suspected of damaging the unborn child |
| **H362** | May cause harm to breast fed children |
| **H370** | Causes damage to organs |
| **H371** | May cause damage to organs |
| **H372** | Causes damage to organs through prolonged or repeated exposure |
| **H373** | May cause damage to organs through prolonged or repeated exposure |

**GHS Environmental Hazard Statements**

|  |  |
| --- | --- |
| **Hazard Code** | **Hazard Statement** |
| **H400** | Very toxic to aquatic life |
| **H401** | Toxic to aquatic life |
| **H402** | Harmful to aquatic life |
| **H410** | Very toxic to aquatic life with long lasting effects |
| **H411** | Toxic to aquatic life with long lasting effects |
| **H412** | Harmful to aquatic life with long lasting effects |
| **H413** | May cause long lasting harmful effects to aquatic life |
| **H420** | Harms public health and the environment by destroying ozone in the upper atmosphere |

**GHS Precautionary Statements – General Actions**

|  |  |
| --- | --- |
| **Precautionary Code** | **Precautionary Statement** |
| **P101** | If medical advice is needed, have product container or label to hand |
| **P102** | Keep out of reach of children |
| **P103** | Read label before use |

**GHS Precautionary Statements – Preventative Measures**

|  |  |
| --- | --- |
| **Precautionary Code** | **Precautionary Statement** |
| **P201** | Obtain special instructions before use |
| **P202** | Do not handle until all safety precautions have been read and understood |
| **P210** | Keep away from heat/sparks/open flames/hot surfaces – no smoking |
| **P211** | Do not spray onto an open flame or other ignition source |
| **P220** | Keep/store away from clothing/…/combustible materials |
| **P221** | Take any precaution to avoid mixing with combustible materials |
| **P222** | Do not allow contact with air |
| **P223** | Keep away from any possible contact with water because of violent reaction and possible flash fire |
| **P230** | Keep wetted with…. |
| **P231** | Handle under inert gas |
| **P232** | Protect from moisture |
| **P233** | Keep container tightly closed |
| **P234** | Keep only in original container |
| **P235** | Keep cool |
| **P240** | Ground/bond container and receiving equipment |
| **P241** | Use explosion proof electrical/ventilation/lighting/…/equipment |
| **P242** | Use only non sparking tools |
| **P243** | Take precautionary measures against static discharge |
| **P244** | Keep reduction valves free from grease and oil |
| **P250** | Do not subject to grinding/shock/../friction |
| **P251** | Pressurised container: do not pierce or burn, even after use |
| **P260** | Do not breathe dust/fumes/gas/mist/vapours/spray |
| **P261** | Avoid breathing dust/fumes/gas/mist/vapours/spray |
| **P262** | Do not get in eyes, on skin or on clothing |
| **P263** | Avoid contact during pregnancy/while nursing |
| **P264** | Wash thoroughly after handling |
| **P270** | Do not eat, drink or smoke when using this product |
| **P271** | Use only outdoors or in a well ventilated area |
| **P272** | Contaminated work clothing should not be allowed out of the workplace |
| **P273** | Avoid release to the environment |
| **P280** | Wear protective gloves/protective clothing/eye protection/face protection |
| **P281** | Use personal protective equipment as required |
| **P282** | Wear cold insulating gloves/face shield/eye protection |
| **P283** | Wear fire/flame resistant/retardant clothing |
| **P284** | Wear respiratory protection |
| **P285** | In case of inadequate ventilation wear respiratory protection |
| **P231** | Handle under inert gas. Protect from moisture |
| **P232** | Handle under inert gas. Protect from moisture |
| **P235** | Keep cool. Protect from sunlight |

**GHS Precautionary Statements – Emergency Response**

|  |  |
| --- | --- |
| **Precautionary Code** | **Precautionary Statement** |
| **P301** | If swallowed: |
| **P302** | If on skin: |
| **P303** | If on skin (or hair): |
| **P304** | If inhaled: |
| **P305** | If in eyes: |
| **P306** | If on clothing: |
| **P307** | If exposed: |
| **P308** | If exposed or concerned: |
| **P309** | If exposed or you feel unwell |
| **P310** | Immediately call a poison centre or doctor/physician |
| **P311** | Call a poison centre or doctor/physician |
| **P312** | Call a poison centre or doctor/physician if you feel unwell |
| **P313** | Get medical advice/attention |
| **P314** | Get medical advice/attention if you feel unwell |
| **P315** | Get immediate medical advice/attention |
| **P320** | Specific treatment is urgent (see…. on this label) |
| **P321** | Specific treatment (see…on this label) |
| **P322** | Specific measures (see…on this label) |
| **P330** | Rinse mouth |
| **P331** | Do not induce vomiting |
| **P332** | If skin irritation occurs: |
| **P333** | If skin irritation or rash occurs: |
| **P334** | Immerse in cool water/wrap in wet bandages |
| **P335** | Brush off loose particles from skin |
| **P336** | Thaw frosted parts with lukewarm water. Do not rub affected area |
| **P337** | If eye irritation persists |
| **P338** | Remove contact lenses, if present and easy to do. Continue rinsing |
| **P340** | Remove victim to fresh air and keep at rest in a position comfortable for breathing |
| **P341** | If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing |
| **P342** | If experiencing respiratory symptoms: |
| **P350** | Gently wash with plenty of soap and water |
| **P351** | Rinse cautiously with water for several minutes |
| **P352** | Wash with plenty of soap and water |
| **P353** | Rinse with water/shower |
| **P360** | Rinse immediately contaminated clothing and skin with plenty of water before removing clothing |
| **P361** | Remove/take off immediately all contaminated clothing |
| **P362** | Take off contaminated clothing and wash before reuse |
| **P363** | Wash contaminated clothing before reuse |
| **P370** | In case of fire: |
| **P371** | In case of major fire and large quantities: |
| **P372** | Explosion risk in case of fire |
| **P373** | Do not fight fire when fire reaches explosives |
| **P374** | Fight fire with normal precautions from a reasonable distance |
| **P375** | Fight fire remotely due to risk of explosion |
| **P376** | Stop leak if safe to do so |
| **P377** | Leaking gas fire: Do not extinguish, unless leak can be stopped safely |
| **P378** | Use ….. for extinction |
| **P380** | Evacuate area |
| **P381** | Eliminate all ignition sources if safe to do so |
| **P390** | Absorb spillage to prevent material damage |
| **P391** | Collect spillage |

**GHS Precautionary Statements – Storage Measures**

|  |  |
| --- | --- |
| **Precautionary Code** | **Precautionary Statement** |
| **P401** | Store… |
| **P402** | Store in a dry place |
| **P403** | Store in a well ventilated place |
| **P404** | Store in a closed container |
| **P405** | Store locked-up |
| **P406** | Store in corrosive resistant/…/container with a resistant liner |
| **P407** | Maintain air gap between pallets |
| **P410** | Protect from sunlight |
| **P411** | Store at temperatures not exceeding…..oC |
| **P412** | Do not expose to temperatures exceeding 50oC |
| **P413** | Store bulk masses greater than ….kg at temperatures not exceeding …. oC |
| **P420** | Store away from other materials |
| **P422** | Store contents under …… |

**GHS Precautionary Statements – Disposal**

|  |  |
| --- | --- |
| **Precautionary Code** | **Precautionary Statement** |
| **P501** | Dispose of contents/container to……. |
| **P502** | Refer to manufacturer/supplier for information on recovery/recycling |

Appendix 2 – **List of substances which are capable of causing cancer / genetic damage, occupational asthma and can be absorbed through the skin**

BMGV: Biological monitoring guidance values

Carc: Capable of causing cancer and/or heritable genetic damage

Sen: Capable of causing occupational asthma

Sk: Can be absorbed through the skin

| **Substance** | **Carc** | **Sen** | **Sk** | **BMGV** |
| --- | --- | --- | --- | --- |
| Acrylamide | X |  | X |  |
| Acrylonitrile | X |  | X |  |
| Allyl Alcohol |  |  | X |  |
| 2-Aminoethanol |  |  | X |  |
| Aniline |  |  | X |  |
| Arsenic and arsenic compounds except arsine (as As) | X |  |  |  |
| Azodicarbonamide |  | X |  |  |
| Benzene | X |  | X |  |
| Benzyl chloride | X |  |  |  |
| Beryllium and beryllium compounds (as Be) | X |  |  |  |
| Bis(chloromethyl) ether | X |  |  |  |
| Bromomethane |  |  | X |  |
| Butane | X  (only applies if butane contains more than 0.1% of buta-1,3-diene) |  |  |  |
| Buta-1,3-diene | X |  |  |  |
| Butan-1-ol |  |  | X |  |
| Butan-2-one (methyl ethyl ketone) |  |  | X | X |
| 2-Butoxyethanol |  |  | X | X |
| 2-Butoxyethyl acetate |  |  | X |  |
| 2-sec-Butylphenol |  |  | X |  |
| Cadmium and cadmium compounds except cadmium oxide fume, cadmium sulphide and cadmium sulphide pigments (as Cd) | X  (cadmium metal, cadmium chloride, fluoride and sulphate) |  |  |  |
| Cadmium oxide fume (as Cd) | X |  |  |  |
| Cadmium sulphide and cadmium sulphide pigments (respirable dust (as Cd)) | X  (cadmium sulphide) |  |  |  |
| Carbon disulphide |  |  | X |  |
| Carbon Monoxide |  |  |  | X |
| Carbon Tetrachloride |  |  | X |  |
| Chlorobenzene |  |  | X |  |
| 2-Chloroethanol |  |  | X |  |
| 1-Chloro-2,3-epoxypropane (Epichlorohydrin) | X |  |  |  |
| Chloroform |  |  | X |  |
| 1-Chloro-4-nitrobenzene |  |  | X |  |
| Chlorpyrifos (ISO) |  |  | X |  |
| Chromium (VI) compounds (as Cr) | X | X |  | X |
| Cobalt and Cobalt compounds  (as Co) | X  (cobalt dichloride and sulphate) | X |  |  |
| Cumene |  |  | X |  |
| Cyanamide |  |  | X |  |
| Cyanides, except HCN, cyanogen and cyanogen chloride (as Cn) |  |  | X |  |
| Cyclohexanone |  |  | X | X |
| 1,2-Dibromoethane  (Ethylene dibromide) | X |  | X |  |
| 1,2-Dichlorobenzene  (ortho-dichlorobenzene) |  |  | X |  |
| 1,1-Dichloroethane |  |  | X |  |
| 1,2-Dichloroethane  (Ethylene dichloride) | X |  | X |  |
| Dichloromethane |  |  | X | X |
| 2,2’-Dichloro-4,4’-methylene dianiline (MbOCA) | X |  | X | X |
| Diethyl sulphate | X |  | X |  |
| N,N-Dimethylacetamide |  |  | X | X |
| N,N-Dimethylaniline |  |  | X |  |
| N,N-Dimethylformamide |  |  | X |  |
| Dimethyl sulphate | X |  | X |  |
| Dinitrobenzene, all isomers |  |  | X |  |
| 1,4-Dioxane |  |  | X |  |
| Endosulfan (ISO) |  |  | X |  |
| Ethane-1,2-diol particulate vapour |  |  | X |  |
| 2-Ethoxyethanol |  |  | X |  |
| 2-Ethoxyethanol acetate |  |  | X |  |
| Ethylbenzene |  |  | X |  |
| Ethylene oxide | X |  |  |  |
| 4-Ethylmorpholine |  |  | X |  |
| Flour dust |  | X |  |  |
| 2-Furaldehyde (furfural) |  |  | X |  |
| Glutaraldehyde |  | X |  |  |
| Grain dust |  | X |  |  |
| Halogeno-platinum compounds (complex co-ordination compounds in which the platinum atom is directly co-ordinated to halide groups) (as Pt) |  | X |  |  |
| Hardwood dust | X | X |  |  |
| Heptan-2-one |  |  | X |  |
| Heptan-3-one |  |  | X |  |
| Hexan-2-one |  |  | X |  |
| Hydrazine | X |  | X |  |
| Hydrogen Cyanide |  |  | X |  |
| 2-Hydroxypropyl acrylate |  |  | X |  |
| 2,2’-Iminodi(ethylamine) |  |  | X |  |
| Iodomethane |  |  | X |  |
| Isocyanates, all (as –NCO) Except methyl isocyanate |  | X |  |  |
| Liquified Petroleum Gas | X  (only applies if LPG contains more than 0.1% of buta-1,3-diene) |  |  |  |
| Malathion (ISO) |  |  | X |  |
| Maleic anhydride |  | X |  |  |
| Methacrylonitrile |  |  | X |  |
| Methanol |  |  | X |  |
| Methyl Isocyanate |  | X |  |  |
| 2-Methoxyethanol |  |  | X |  |
| 2-(2-Methoxyethoxy) ethanol |  |  | X |  |
| 2-Methoxyethyl acetate |  |  | X |  |
| (2-methoxymethylethoxy) propanol |  |  | X |  |
| 1-Methoxypropan-2-ol |  |  | X |  |
| 1-Methoxypropyl acetate |  |  | X |  |
| 4,4’-Methylenedianiline | X |  | X | X |
| N-Methylaniline |  |  | X |  |
| n-Methyl-2-pyrrolidone |  |  | X |  |
| 5-Methylhexan-2-one |  |  | X |  |
| 4-Methylpentan-2-ol |  |  | X |  |
| 4-Methylpentan-2-one |  |  | X | X |
| Monochloroacetic acid |  |  | X |  |
| Morpholine |  |  | X |  |
| Nickel and its inorganic compounds (except nickel tetracarbonyl):  Water-soluble nickel compounds (as Ni) nickel and water-insoluble nickel compounds (as Ni) | X  (nickel oxides and sulphides) | X  (nickel sulphate) | X |  |
| Nicotine |  |  | X |  |
| Nitrobenzene |  |  | X |  |
| 2-Nitropropane | X |  |  |  |
| Phenol |  |  | X |  |
| p-Phenylenediamine |  |  | X |  |
| Phorate (ISO) |  |  | X |  |
| Phthalic anhydride |  | X |  |  |
| Piperazine |  | X |  |  |
| Piperazine dihydrochloride |  | X |  |  |
| Piperidine |  |  | X |  |
| Polychlorinated biphenyls (PCB) |  |  | X |  |
| Propan-1-ol |  |  | X |  |
| Propylene oxide | X |  |  |  |
| Prop-2-yn-1-ol |  |  | X |  |
| Refractory ceramic fibres and special purpose fibres | X |  |  |  |
| Resorcinol |  |  | X |  |
| Rosin-based solder flux fume |  | X |  |  |
| Rubber fume | X |  |  |  |
| Rubber process dust | X |  |  |  |
| Sodium azide (as NaN3) |  |  | X |  |
| Softwood dust |  | X |  |  |
| Subtilisins |  | X |  |  |
| Sulfotep (ISO) |  |  | X |  |
| 1,1,2,2-Tetrabromoethane |  |  | X |  |
| Tetrahydrofuran |  |  | X |  |
| Thallium, soluble compounds (as TI) |  |  | X |  |
| Tin compounds, organic, except Cyhexatin (ISO), (as Sn) |  |  | X |  |
| Toluene |  |  | X |  |
| o-Toluidine | X |  | X |  |
| 1,2,4-Trichlorobenzene |  |  | X |  |
| Trichloroethylene | X |  | X |  |
| Triethylamine |  |  | X |  |
| Triglycidyl isocyanurate (TGIC) | X |  |  |  |
| Trimellitic anhydride |  | X |  |  |
| 2,4,6-Trinitrotoluene |  |  | X |  |
| Vinyl Chloride | X |  |  |  |
| Xylene o-, m-, p- or mixed isomers |  |  | X | X |

Appendix 3

**Guidance on the Estimation of Workplace Exposure Limits**

1. Introduction

Many people work with a variety of substances at work (e.g. chemicals, fumes, dusts fibres) which can, under some circumstances, have a harmful effect on their health. These are called ‘hazardous substances’. If exposure to a hazardous substance is not adequately controlled it may cause ill health in a number of ways. The substance may cause harm by:

* Too much being taken into the body through breathing;
* Being absorbed through the skin;
* Being swallowed; or
* Acting directly on the body at the point of contact, e.g. the skin.

Some illnesses caused by exposure to hazardous substances in the workplace (occupational diseases) may not appear until a long time after the first exposure. Therefore, it is important to know in advance how to protect the health of staff and students working with hazardous substances and also of other people who may be affected by the work being carried out.

1. Workplace Exposure Limits (WELs)

WELs are UK occupational exposure limits and are set in order to help protect the health of workers. WELs are concentration limits of hazardous substances in the air, averaged over a specified period of time, referred to as a time-weighted average (TWA). Two time periods are used:

* Long-term (8hours); and
* Short-term (15 minutes)

Short-term exposure limits (STELs) are set to help prevent effects such as eye irritation, which may occur following exposure for a few minutes.

1. WELs and the Control of Substances Hazardous to Health (Amendment) Regulations 2005 (COSHH)

Substances that have been assigned a WEL are subject to the requirements of COSHH. The absence of a substance from the list of WELs (EH40/2005) does not indicate that it is safe. For these substances, exposure should be controlled to a level to which nearly all the working population could be exposed, day after day at work, without any adverse effects on health.

1. Inhalation – vapours

Likely airborne concentrations of vapours from volatile liquids can be predicted from the volume of volatile liquid used in a process and the volatility of that liquid using Table 1 below:

**Table 1: Prediction of Vapour-in-Air Concentrations (ppm)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Control**  **Approach** | **Predicted Vapour-in-air concentrations (ppm)** | | | |
| m3 quantities of high VP\* material | m3 quantities of medium VP material or l quantities of medium to high VP material | ml quantities of medium to high VP material or m3  quantities of low VP material | ml quantities of low VP material |
| General ventilation  (work on bench) | >500 | 50 – 500 | 5 – 50 | <5 |
| In fume cupboard  (or close to LEV) | 50 – 500 | 5 – 50 | 0.5 – 5 | <0.5 |
| Totally contained  (in Glove-Box or Class III Biological Safety Cabinet) | 0.5 – 5 | 0.5 – 5 | 0.05 - .0.5 | <0.05 |

**\*VP – Vapour pressure**

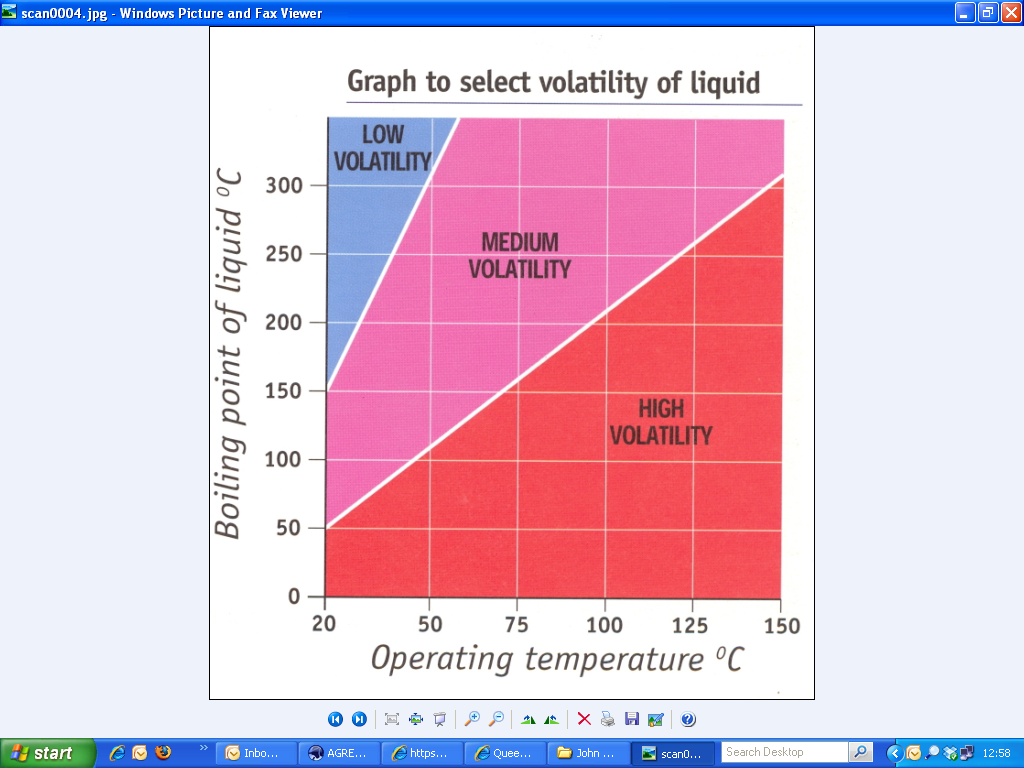
The volatility of a liquid can be categorised from its vapour pressure (VP).

|  |  |
| --- | --- |
| **Range of Vapour Pressure** | **Volatility** |
| 0 – 30mm Hg | Low |
| 30 – 100mm Hg | Medium |
| >100mm Hg | High |

For a mixture of solvents, the overall volatility will be that of the volatility of the major component in that mixture.

If vapour pressures are not readily available, the volatility can be categorised from the boiling point of the liquid and the process working temperature using Graph 1 below:

Graph 1:

****

Example:

If the process you are carrying out involves the use of ml quantities of a medium-to-high volatility liquid, on the open bench (Row 1 of Table 1) over a full working day, you would expect the concentration of the vapour in the air to lie between 5-50ppm.

1. Inhalation - dusts

Similarly, Table 2 below can be used to predict the concentration of dust in the air arising from a work process.

In this instance the dustiness of the material would be categorised as:

|  |  |
| --- | --- |
| **Material** | **Dustiness** |
| Pellet like | Low |
| Crystalline / Granular | Medium |
| Fine light powders | High |

**Table 2: Prediction of Dust-in-Air Concentrations (mg/m3)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Control**  **Approach** | **Predicted Dust-in-air concentrations (mg/m2)** | | | |
| Tonne quantities of medium to high dusty material | kg quantities of medium to high dusty material | g quantities of high dusty material or kg to tonne quantities of low dusty material | g quantities of medium to low dusty material |
| General ventilation  (work on bench) | >10 | 1 - 10 | 0.1 - 1 | 0.01 – 0.1 |
| In fume cupboard  (or close to LEV) | 1 - 10 | 0.1 - 1 | 0.01 – 0.1 | 0.001 – 0.01 |
| Totally contained  (in Glove-Box or Class III Biological Safety Cabinet) | 0.1 - 1 | 0.01 – 0.1 | 0.001 – 0.01 | <0.001 |

Example**:**

If the process you are carrying out involves the use of gram quantities of a medium-to-low dusty material, on the open bench (Row 1 Table 2) over a full working day, you would expect the concentration of the dust in the air to lie between 0.01 – 0.1mg/m3.