College of Science
Env. Science and Health Dept.

زانکۆی سەلاحەدین - هەولێر
Salahaddin University-Erbil

Principles of Control in Health and Safety

Slides supplied by Fars Zedan

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Lecture: 4

Engineering Controls

These involve the elimination of hazards or hazardous work processes at

- the design stage,
- by designing safety into plant, equipment and machinery, etc.,

Engineering controls provide plant and equipment with built-in safety features and add particular safety equipment to processes in order to remove or reduce risks.

a) Designing for Safety

- Good design and construction should include the following types of features:

1. Operating controls which are easy to see and use, do not allow machines to be turned on accidentally and incorporate emergency stops.
2. Fail-safe devices which do not allow a machine to operate if there is a fault.
4. Fire doors and other containment measures which come into operation automatically when a sensor sets off an alarm.
5. Hazard lights and sounds which operate in hazardous circumstances, such as when a large vehicle is reversing.

b) Ventilation Systems

These are examples of additional controls used to reduce risk from airborne contaminants. Two types are in common use:

i. Dilution Ventilation

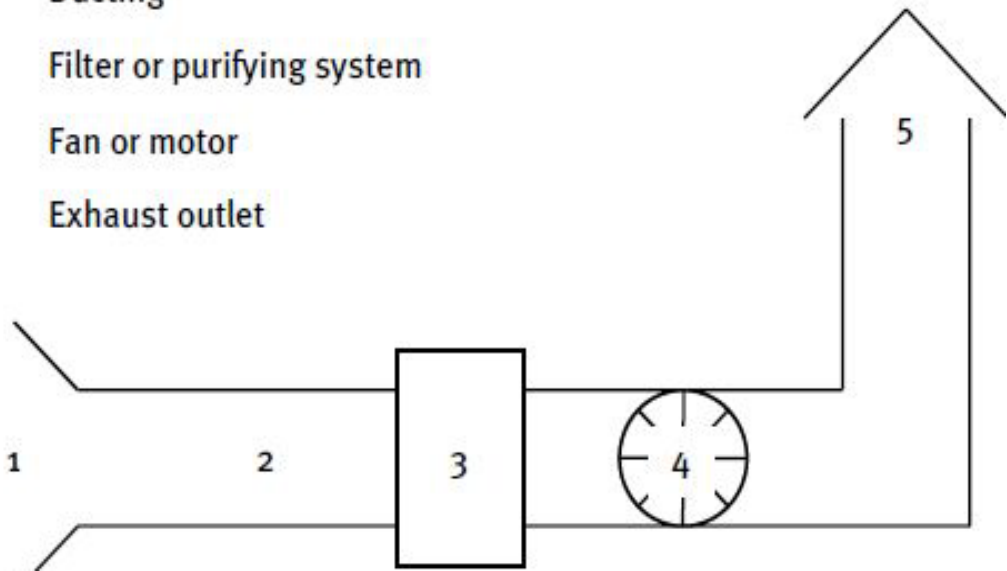
Dilution ventilation works by reducing the concentration of the hazard to an acceptable level.

For example, the level of gaseous contaminants (and sometimes fumes) in the air may be reduced by changing the whole workplace air over a given period of time. The workplace air is extracted by the use of fans set in the walls or roof.

ii. Local Exhaust Ventilation

In general, these systems are made up of five main parts:

1. The hood or exhaust inlet
2. Ducting
3. Filter or purifying system
4. Fan or motor
5. Exhaust outlet



Personal Protective Equipment

- Despite considering the range of control measures outlined previously, it may still not be possible to reduce exposure to a risk down to an acceptable level. Under such circumstances it becomes necessary to consider protecting the individual rather than the working environment as a whole.
- However, in the hierarchy of control measures, personal protective equipment (PPE) comes last and is only used when all other control measures have been found inadequate in eliminating or controlling the risk.
- PPE is used when it has not been possible to eliminate the hazard or reduce risk to acceptable levels by the use of engineering controls, working methods or working patterns.

PERMITS-TO-WORK

- A permit-to-work system is designed to ensure that all necessary actions are taken before, during and after particularly hazardous operations.

- **Permits-to-work** are formal written documents specifying the work to be done and the precautions to be taken. Work can only start when it is confirmed that it is safe to do so, and the work must be carried out strictly according to the requirements of the permit. On completion, confirmation is required that all safety measures have been reinstated before any further work can commence.

- Note that a "permit-to-work system" should not be mistaken for a "safe system of work". Rather, a safe system of work may require a permit-to-work system to be adopted as part of its overall systematic control of risk.

Typical Permits and Appropriate Circumstances

The types of hazardous situations in which permit-to-work systems should be used include work in the areas outlined below.

1. Hot Work

Hot work permits are concerned with preventing fires/explosions (such as burning ,welding, use of a naked flame, etc).

2. Work on Electrical Systems

The hazards associated with electricity are frequently either not understood or are treated in too casual a manner. High voltage equipment (in practical terms; 440 volts AC or higher).

3. Machinery Maintenance

The biggest risk to maintenance workers is that they may be injured if machinery is started up while work is still in progress. Typical methods of isolation include:

- Locking-off switch handles.
- Removing drive belts.
- Locking the clutch.
- Using key interlock systems.

4. Confined Spaces

The following precautions should be included in the permit-to-work:

- Mechanical and/or electrical isolation of the confined space.
- Adequate ventilation to ensure a sufficient supply of respirable air.
- Cleaning and purging to remove all hazards, particularly in respect of dangerous fumes, and testing to ensure their absence.
- A specified working period, which is not to be exceeded in any circumstances.

Safe Systems of Work

- A **safe system of work** is a formal procedure which results from a systematic examination of the tasks of a work process in order to identify all the hazards and define methods of working which eliminate those hazards or minimise the risks associated with them.
- The procedure must be followed at all times in order to work safely in relation to the hazards.

- Instruction, training and supervision form an important part of safe systems because only people who are competent by means of appropriate training and instruction may be allowed to undertake the work. Supervision is necessary to ensure that staff follow instructions and their training.

Technical, Procedural and Behavioural Controls

A safe system of work will involve all the elements of control that we identified in the general hierarchy of control:

1. **Technical, or engineering, controls** are those which are applied directly to the hazard itself in order to minimise the risk.
2. **Procedural controls** are those defined in the way in which work should be carried out in relation to the hazard.
3. **Behavioural controls** relate to how the individual operator, or groups of workers, act in relation to the hazard.

Emergency procedures

- The main objective of emergency procedures is to provide a safe environment for workers during an emergency and to limit the loss of property.

- Hazards that should be included in a risk assessment relating to emergency procedures are those hazards at the workplace, and also those at nearby facilities which may affect it.