Safety signs - teacher

**Virtual tour of Safety Signs in a corridor and adjacent areas – teacher notes**

# Introduction

A number of applied school science courses recommend that students should make a site visit to some aspect of the chemical industry. Such visits are often difficult to organise and some areas are almost impossible to get access to. Major constraints on organising visits to laboratories, pilot plants or production sites are time, space, safety and compliance with Good Manufacturing Practice. Visitors are prohibited in some areas when active large scale chemistry is underway and therefore planning visits weeks in advance becomes impracticable.

To partly address the needs of applied science courses and some A-level chemistry courses, virtual visits of the chemistry laboratories and pilot plant on a pharmaceutical company’s sites has been created. The Safety Signs tour is a complementary resource which focuses on signs in the laboratory buildings and includes many aspects of Health & Safety and environmental protection. Although students can navigate round them at leisure, there may be benefits from them being teacher led using a projected image from the web site. Questions are also provided to enhance the learning experience.

The safety signs virtual tour can be accessed on [www.abpischools.org.uk](http://www.abpischools.org.uk) in the Safety at work topic. A PowerPoint version is also available.

The text that appears in the info box on screen is reproduced here. Answers to questions and discussion points are given in italics. A version without the answers can be given to students.

On all of the laboratory doors there are blue signs - Eye protection must be worn. Next to the door is a rack for safety spectacles. Why are they positioned here?

• It is a strict rule that safety spectacles must be worn at all times in the laboratories. The signs are to alert visitors to put on safety spectacles that are provided before entering the lab. The racks are checked regularly.

There are small blue circular signs on all doors - Fire door keep shut. Why is this instruction so important? What is a “Fire door”? What must you never do?

• Fire doors are specially designed to prevent fire spreading. Their construction is such that even a raging fire will take a significant time to burn through it. These doors and the walls of the various rooms divide the building up into relatively small zones to prevent fire spreading and for people’s safety. Fire doors must never be wedged open.

What does the green sign above the door indicate?

• The green “running man” sign indicates the main exit route in case of fire. The signs are above all main exit doors.

A red Fire extinguisher sign close to the exit door. Why are the extinguishers placed there and not on the wall in the middle of the corridor?

• They are next to the exit door so that anyone fighting a fire does not have to go past a fire to get one and they have a safe exit route behind them.

There are three sorts of fire extinguishers located in the corridor. The label for the contents of one is not visible – what do you think it contains? (Note the wide exit tube).

• It contains carbon dioxide.

Why is there a need for different types of extinguishers? What is each used for and what are the drawbacks of each?

• Foam is for most burning materials such a paper. It is water based and can not be used for electrical fires or on anything that reacts with water – e.g. potassium. The foam cools the fire and restricts contact with air. This type of extinguisher is pressurised with either air or nitrogen to create the foam.

• Dry powder is good for all types of fires. It covers the fire with dry solid, cooling it, and preventing oxygen getting to it. It makes a mess but that is preferable to the result of a fire. It is the best all round type of extinguisher – especially in chemical laboratories.

• Carbon dioxide stops oxygen getting to the flame. It can be used on most fires, being especially good for electrical and solvent fires, but some chemicals will react with it. It comes out of the extinguisher horn very fast and there can be a risk of spreading small burning objects.

This is a safety shower. There is a green Emergency shower sign on the wall. What do you think the shower is for? How is it used in an emergency? Why is it located here? There is no drain hole – why not, and what happens to the water?

• It is for drenching a chemist with water in case of severe splashes from dangerous chemicals. It has never been used, but is tested regularly. A lab coat and any contaminated clothing would be thrown off before activating the shower. It is in the corridor outside the lab so that any chemicals washed off do not contaminate the lab. It is in the centre of this section of corridor and close to each of the labs. Other showers are strategically placed throughout the building.

• The building is designed for safety. There are no holes through the floors which are solid slabs and are therefore fire and water proof. Fire can spread from one floor to another through drain holes. A water flood can spread to the floor below through drains. It is therefore much safer to eliminate the drain hole and just mop up the water from the shower. The spread of water can be contained using absorbent in “sausages” round the area.

The yellow Cyanide in use sign is in a holder outside the lab door. Why is it here? Can you work out what the “green cross” notice below it is for? Cyanides are very poisonous but may be used regularly by the chemists. They don’t wear any special safety gear, so what do they do to ensure they are safe?

• The sign is outside the lab door so that visitors are alerted and night time security are aware of the hazard. The extra detail in black pen says that it is 16.5 mg of zinc cyanide. Underneath the Cyanide in use sign is a set of first aid instructions (green cross) for use with cyanides. There is also a code of practice for summoning help (not shown).

• Specific risk assessments are carried out to ensure that the hazards are minimised, for example, the quantity used is the minimum needed; all work is done in a fume cupboard; a lab coat, gloves and safety spectacles are worn; aqueous bleach is on hand to destroy any cyanide spills and destroy any residual material (it oxidises cyanides to cyanate); all equipment is soaked in bleach at the end of the experiment; the cyanide experiment is only started once the Health Centre has agreed to be on stand-by.

A yellow Compressed gas sign is outside the lab where cylinders of compressed gas are being used. It tells visitors to the lab that there is a potential hazard inside. Compressed gas cylinders are very hazardous if not used carefully.

The large cylinders in use are colour coded - nitrogen (grey) and hydrogen (red). They are heavy and can easily topple over if not secured in a stand. Valves must be put on by a trained person and training must be given to users so that rapid release of gas is avoided. Most cylinders have right handed screw threads on the valve connectors but the hydrogen ones have left handed threads. Why?

• This is for added safety, hydrogen cylinders have left handed threads so that they can never be accidentally attached to an oxygen cylinder or tubing full of oxygen.

On the bench next to the fume cupboard is a bag marked SPILLAGE KIT Absorbent. How would you use it?

• It contains granules for absorbing liquid spills. They are essentially the same as cat litter. The granules would be incinerated after use.

On the wall next to the fume cupboard is a plastic bottle with a green top. What is this for (note the trade name on the bottle for a clue)? What do you think it contains? How would you use it to?

• Note the name Optrex – it is an eyewash bottle containing dilute salt solution to flush out contaminated eyes. If a chemist should get a chemical splashed in their eye, they are laid on their side on the floor with the contaminated eye nearest the floor. The green top is snapped off the bottle and a gentle stream of water poured from the corner of the eye near the nose across the eye to wash away contamination. The helper holds the eye open. This process needs to be done for quite some time with a number of bottles. The Health Centre would be called to attend and give follow-up treatment.

There is Handwash basin next to the exit door.

In the lab is an ultra violet light source used to visualise organic compounds on chromatography plates. It is housed inside the box to prevent people being exposed to it accidentally. The yellow sign is Caution U.V. Light. Find out more about chromatography plates in the Synthetic lab tour.

The yellow sign Caution, strong magnetic field is on the door outside the lab containing a nuclear magnetic resonance machine (NMR). The machine creates a large magnetic field which enables chemists to “look” at the chemical environment of certain atoms (normally hydrogen). Find out more about NMR in the Analytical lab tour.

The red sign No entry for persons with heart pacemakers, electronic or metal implants is a warning because strong magnetic fields can disrupt the rhythm of heart pacemakers and other electronic controls. Metal implants can disrupt the magnetic field and generate heat in the magnet which can lead to other hazards.

Keep iron or magnetisable objects away from the strong magnetic field. Iron etc can disrupt the magnetic field and generate heat in the magnet which can lead to other hazards. The NMR machine (grey cylinder marked 400 Ultra Shield) has two warning signs on it which are difficult to read in the main picture – one states STRONG MAGNETIC FIELDS and the other is a drawing of a horseshoe magnet attracting a spanner. Why do you think there is a small fence round the NMR machine?

• The area inside the safety fence is where the magnetic field is strongest and will affect heart pacemakers, credit cards and phones.

The yellow sign on the outside of a cupboard is Highly flammable liquid. The cupboard contains flammable solvent. What do you think the inner part of the flammable solvent cupboard is made of and why is there a lip at the front?

• It is made of steel to maximise the protection from external fires. The large lip at the front is to create a well to contain any spillages.

The red containers on the floor are for waste flammable solvents. The label on the side is difficult to see but says SAFETY DISPOSAL CAN. Why are the containers sitting in trays, and why have they got a metal gauze inside the opening? (Hint: find out about Sir Humphrey Davy and the miners’ safety lamp). How do you think the waste flammable solvent is disposed of? How does your school dispose of solvents?

• The trays are to prevent any spills spreading over the floor.

• A metal gauze spreads the heat of a flame so much that the fire can not travel through it. It prevents flames spreading to the contents of the container.

• All waste solvent is burnt on site in a highly efficient incinerator. This gives the pharmaceutical company complete control over the fate of waste and it would be irresponsible to pass it on to someone else to dispose of.

The bin by the sink is for chemically contaminated solids. It is for waste that might be contaminated with chemicals. What chemically contaminated items can be seen in the red bag in the waste bin? What else might go in there? What ways are there of disposing of the contents of the red bag safely?

• Plastic disposable gloves (white and purple), tissues, a top from a solvent bottle and clear plastic wrappers – probably clean).

• Filter papers, plastic bottles that chemicals were delivered in, plastic Pasteur pipettes, rubber teats, plastic thin layer chromatography plates, plastic tips from auto-pipettes, plastic or rubber tubing, anhydrous sodium or magnesium sulphate that are used as drying agents, used solid phase extraction cartridges and chromatography columns.

• All solid waste is incinerated to burn off all chemicals. Any residual solid after incineration is sent for landfill.

The blue bin is for waste glass that is contaminated with chemicals. It is placed in special bins marked CONTAMINATED GLASS. What ways are there of disposing of the contents safely?

• By incineration to burn off all chemical contaminants. The safe glass is then recycled.

The yellow bins are biohazard waste. The yellow plastic bag (bin) marked BIOHAZARD WASTE is not enclosed so that it is obvious that this is special waste. What ways are there of disposing of the contents safely?

• By incineration to burn off all chemical and biological contaminants.

The plastic tub marked DANGER CONTAMINATED SHARPS ONLY is for glass and needles contaminated with Biohazards – note the Biohazard symbol even though the wording is not clear in the picture. It contains blood samples.

Fire Zones and Assembly Area signs are on all main exit routes to show fire escape routes to assembly areas.

All staircases have FIRE ACTION instruction notices with a break-glass alarms.

Recap

The signs that you have seen on this tour are various colours and shapes. Why is this?

What types of signs are blue and circular? Mandatory instructions.

What types of signs are green and rectangular? Emergency information.

What types of signs are yellow and triangular? Warnings.

What types of signs are red and circular? Warning and prohibitory instructions (DO NOT do something).