CHEMICALS AT WORK

DR ALAN LE SERVE, LEAD CONSULTANT, COSHE
A FEW BASIC FACTS

- 400 million tons produced annually;
- 5 – 7 million known chemicals;
- more than 80,000 commercial chemicals in use;
- more than 1,000 new chemicals produced each year;
- perhaps 10,000 commercial chemicals are hazardous; and
- more than 200 are thought to be carcinogens;

THERE IS LITTLE AWARENESS OF CHEMICALS AT WORK!
The statement - 'No one knows the effects of Combining Chemicals' ws removed. Not sure what Dr. LeServe was saying but there is much evidence available of the hazardous effects of chemicals reacting with each other.

Michael, 30/10/2011
All occupations involve chemicals

- agricultural workers – pesticides
- garment workers – spot cleaners/dyes
- office workers – inks/photocopiers
SOME OF THE MAIN TOXIC EFFECTS OF CHEMICALS

IRRITANT or CORROSIVE

- inflammation/blistering of the skin (dermatitis)
- burning of skin, eyes

Short-term exposure frequently heals whereas long-term exposure can lead to chronic illnesses. Examples: ammonia, sulphuric acid, caustic soda.
Added: chronic illnesses
Michael, 31/10/2011
THIS WORKER IS USING CAUSTIC SODA IN A HOT, HUMID WORKPLACE.
ALLERGENIC: For susceptible workers, they can produce asthma-like symptoms (lungs) or industrial dermatitis (skin). Examples: TDI (toluene di-isocyanate), epoxy resins, formaldehyde.
Added: , they can
Michael, 31/10/2011
FIBROGENIC - gradual cumulative loss of lung function as “elastic” alveolar tissues are damaged by dust.

e.g.: bauxite, bagasse, coal, asbestos.
Omitted: look at these two....and their dust exposure

Michael, 31/10/2011
ASPHYXIANT - chemicals which stop the normal absorption of oxygen by the body either by replacing the oxygen or inhibiting its uptake. Example: carbon monoxide.

Workers inside closed spaces are at danger – workers have to clean inside these vats and should have airline respirators.
M3

Added: airline respirators
Michael, 31/10/2011
NARCOSIS – condition caused by chemicals which depress the CNS and produce “light headedness” which can be a factor in accidents, e.g. solvents.

Danger of falls if working at height or injury if working with unguarded machinery.
Added: condition caused by Michael, 31/10/2011
POISONOUS/TOXIC - chemicals that cause damage of cells in vital organs leading to failure of that organ to function effectively. Ultimately can lead to death.

Examples: lead (liver and kidneys); organophosphates – used as insecticides (CNS and synapses).
M7  Added: lead
    Michael, 31/10/2011

M8  Added: - used as insecticides
    Michael, 31/10/2011
WORKER MIXING PESTICIDE WITHOUT PPE
CARCINOGENIC - chemicals that cause cancer in exposed workers usually over a long period of time (10 – 40 years)

Examples: arsenic, asbestos, chromium, nickel, 2-napthylamine, VCM

WORKERS IN A BRAKE LINING FACTORY EXPOSED TO ASBESTOS.
TERATOGENIC AND MUTAGENIC - can effect foetus in the womb or eggs/sperm for future generations.
**INHALATION** - breathing in workplace chemicals is the most significant route of entry.

Safety devices: Nasal hairs; cilia/mucous; macrophages (perc CS).
SKIN CONTACT
- often the most obvious route of exposure, especially where the chemical has a local effect.
ROUTES OF ENTRY OF CHEMICALS

INGESTION

- when eating or smoking with contaminated hands; and
- when inhaled particles are swallowed.
INHALATION

• dusts: silica, coal, asbestos, lead, cotton, wood, cement

• mists: acid mists

• gases: chlorine, carbon monoxide/dioxide

• fumes: smoke, welding/metal fumes

• vapours: solvents
SKIN CONTACT
• corrosive action directly on the skin: acids, alkalis, phenols
• absorption through the skin: pesticides
• action on mucous membrane of the eye: acids, some vapours
• “degreasing” action of solvents on skin oils: diesel, solvents.
INGESTION - all the above when eating/smoking with contaminated hands
KEY FACTORS IN THE EFFECT OF CHEMICALS ON WORKERS

1. The chemical type (acid, alkali, organophosphates, esters, etc).
2. The physical form of the chemical (dust, fume, vapour, solid, etc).
3. The route of entry (inhalation, skin contact, ingestion).
4. The tissues and organs in the body in which it collects/targets.
5. The frequency, duration and concentration of exposure.
6. The worker’s response/susceptibility to the chemical.

NOT ALL WORKERS RESPOND IN THE SAME WAY!
OTHER KEY FACTORS

ACUTE EFFECT - an “immediate” effect usually caused by a single short-term exposure to a chemical (e.g. an acid burn).

CHRONIC EFFECT - an effect usually caused by repeated exposure to a chemical over a long period of time (e.g. asbestosis)

LOCAL EFFECT - the chemical causes its effect/damage at the site of exposure (e.g. acid burn, asbestosis)

SYSTEMIC EFFECT - after entering the body the chemical is transported via the blood, lymph etc to other target organs (e.g. pesticides to the CNS, 2 napthylamine to the liver) where it causes its effect.
1. **RECOGNITION**

- Direct Health Indicators - Are specific workers off sick more than others? Do any workers have obvious health effects from working with a specific chemical?

- Experience/knowledge of a specific chemical - Managers should have approved Material Safety Data Sheets – MSDSs – for all chemicals used in their workplaces as should the Inspectorate.

- Observation - During a walkthrough survey, an inspector should observe: (a) any process involving chemicals and the number of workers involved; (b) how the materials are stored, handled, used and disposed of; (c) whether MSDSs are available and workers know how to use the chemical; and (d) what engineering controls or personal protective equipment is used.)
2. EVALUATION

Evaluating or measuring the risks of chemicals is difficult. This normally involves taking samples and comparing with recognized exposure limit standards. This is often time consuming, expensive and open to different interpretations. Often the equipment gives only a “qualitative” snap-shot value. Evaluating the risk means ranking them as low, medium, or high depending upon the toxicity of the chemical, duration of exposure, type of exposure, use of PPE etc.

Many countries do not have the requisite equipment for accurate monitoring of workplace chemicals.
3. CONTROL

Chemicals can be controlled by a series of methods including:

- Elimination
- Substitution
- Isolation
- General and local exhaust ventilation
- Administrative controls
- Personal Protective Equipment
The most effective way of controlling hazards is at source. However, PPE is often selected as it is the cheapest alternative.
A FEW EXAMPLES

■ ELIMINATION
  Do you actually need the chemical at all?

■ SUBSTITUTION
  Is there a SAFE substitute? Example: asbestos – wollastonite; cellulose.
  Fibres, PVAs polyvinyl alcohol fibres
  Example: napthylamine and B-napthylamine!

Is it safer, as cheap and as effective?
REMEMBER: For it to work, it must have many of the same characteristics and we may not know that it is just as harmful after a latent period!
Try to use safe substitutes wherever and whenever possible BUT you must ensure that they really are SAFER than the original.
ISOLATION – The use of a physical barrier along the hazard path to separate the workers from the exposure

Glass is used in this asbestos factory as a means of isolation.

Note the broken window – isolation is not effective.
LOCAL EXHAUST VENTILATION

LOCAL EXHAUST VENTILATION SUCKS THE DUST AWAY AT SOURCE
PERSONAL PROTECTIVE EQUIPMENT (PPE)

INCORRECT PPE USED: SURGICAL MASKS INSTEAD OF DUST RESPIRATORS
Try to ensure that there is a good seal between the face and the mask. There should be no gaps. Tracking or pressure tests can help.
PERSONAL PROTECTIVE EQUIPMENT (PPE)

CORRECT PERSONAL PROTECTIVE EQUIPMENT (PPE)

INCORRECT PERSONAL PROTECTIVE EQUIPMENT (PPE)
THE PPE MUST BE OF THE CORRECT TYPE

Half-face respirator with High Efficiency Particulate Air (HEPA) filters – for asbestos
PERSONAL PROTECTIVE EQUIPMENT (PPE)

WORKER MIXING PESTICIDES

Gloves, respirator and goggles.

THIS WORKER IS USING TRICHLOROETHYLENE....

Respirator, goggles, rubber gloves and LEV but still a few OSH issues......No apron, and bare arms and feet.
IF YOU DO USE PERSONAL PROTECTIVE EQUIPMENT (PPE)

- make sure it is the best available;
- make sure that it is the correct PPE for the hazard;
- make sure that the PPE is well maintained; and
- make sure workers know how to use it correctly.
MATERIAL SAFETY DATA SHEETS

MSDSs should contain the following information and be in a LANGUAGE and FORMAT that can be understood by all concerned.

1. Description of the chemical
2. Effects of short-term exposure (inhalation, eye contact, skin contact and ingestion)
3. Effects of long-term exposure
4. Fire and explosion risks
5. Chemical reactivity – how it reacts with other chemicals, etc.
6. Personal protection
7. First aid
8. Storage and handling; Clean-up and disposal.
READ THE LABELS
FIRE SAFETY - The type of extinguisher MUST match the potential type of fire

Dry powder extinguisher used for A, B, & C fires
Many employers and workers don’t know about the dangers of chemicals they work with everyday.
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<thead>
<tr>
<th><strong>CHECKLIST</strong></th>
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<tr>
<td>Do any processes in the factory produce dusts, fumes or vapours?</td>
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<td>Are local exhaust ventilation systems in use to reduce the levels of dusts, fumes or vapours in the sections?</td>
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<tr>
<td>Are MSDSs[1] available for all chemicals used in the factory?</td>
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<td>Are the provisions of the MSDSs, in particular the safe use of the chemical, fully understood by the workers who use them?</td>
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<td>Are the chemicals used and stored as directed in the MSDS?</td>
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<td>Is there any medical surveillance programmes undertaken with the workers who use these chemicals?</td>
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<td>Are other workers who are not involved in the process exposed to the chemicals?</td>
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<td>Have any workers who work in these areas complained of respiratory or skin problems etc?</td>
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<td>In the absence of engineering controls, are the workers provided with PPE?</td>
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<td>Is the PPE of the correct type for the hazard concerned according to the MSDS?</td>
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<td>Is the PPE regularly checked/changed at no cost to the worker?</td>
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<tr>
<td>Do workers know what action to take in the case of spillage and disposal of the chemicals?</td>
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A NUMBER OF CASE STUDIES ON CHEMICALS ARE AVAILABLE