OH&S, WHS, EHS, A+G...
Overview

• Introduction
• OHS Law
• Risk management
• MSDS
• Dangerous goods code
• Giftklasse

• EU labelling
• Laboratory specifics
Introduction

• OHS, WHS, EHS, AG, … what does it mean?
• Basic concept: An employer has a duty-of-care towards the health and safety of her employees. Not only to provide safe workplace, but also appropriate training.
• Employees have a reciprocal duty to follow the regulations set out by their employer, and a duty to not place themselves or their co-workers knowingly in danger.

Verordnung über die Verhütung von Unfällen und Berufskrankheiten
How does this affect you?

• The moral aspect…
• One day you’ll have a REAL job…
• You have a legal responsibility…

2003:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Berufsunfälle</td>
<td>62 751</td>
<td>62 215</td>
<td>66 525</td>
<td>65 978</td>
<td>257 469</td>
</tr>
<tr>
<td>Nichtberufsunfälle</td>
<td>126 266</td>
<td>119 409</td>
<td>130 427</td>
<td>101 016</td>
<td>477 118</td>
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<tr>
<td>Unfälle von Stellensuchenden</td>
<td>4 047</td>
<td>4 526</td>
<td>5 077</td>
<td>4 436</td>
<td>18 086</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>193 064</strong></td>
<td><strong>186 150</strong></td>
<td><strong>202 029</strong></td>
<td><strong>171 430</strong></td>
<td><strong>752 673</strong></td>
</tr>
</tbody>
</table>
Die Vorschriften über die Arbeitssicherheit gelten für alle Betriebe, die in der Schweiz Arbeitnehmer beschäftigen.

Eidgenössische Koordinationskommission für Arbeitssicherheit (EKAS)
Risk Management

• What is risk? The chance of a negative outcome

\[ \text{Risk} = \text{frequency} \times (\text{probability of control failure}) \times (\text{severity of injury/damage}) \]

• What is a hazard? Something with the potential to cause harm.

• Why do a risk assessment? Money, damage to infrastructure, employees, public perception, legal, moral…

• 4 steps:

![Risk Management Diagram]

- Hazard Identification
- Risk Assessment
- Risk control
- Monitoring & Evaluation

Diagram: Flowchart showing the risk management process.
1. Hazard Identification

What types of hazards are there?
• Chemical
• Biological
• Radiation
• Mechanical
• Sound
• …

Examples:
Bottle of compressed oxygen gas

Primary source of chemical hazard information:
MSDS
Resources

- [http://www.msdssearch.com](http://www.msdssearch.com) links to many MSDS databases
- Inhouse programs ie Chemwatch, Gefahrlich Rxn
- [http://www.sigmaaldrich.com](http://www.sigmaaldrich.com) etc …
- [http://www.snv.ch](http://www.snv.ch) Schweizerische Normen-Vereinigung, also DIN, BSI, ASA, ANSI
- Printed ie SAX
- Your brain…
2. Risk Assessment - Nomogram

<table>
<thead>
<tr>
<th>Substances</th>
<th>Form</th>
<th>Hazards</th>
<th>Routes of Exposure</th>
<th>Evidence of Exposure</th>
<th>Current Controls</th>
<th>Risk Factors</th>
<th>Risk Result</th>
<th>Actions arising from assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSC-detected</td>
<td>Ultrasound</td>
<td>Health effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linked zone</td>
<td>Gas, oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linked zone</td>
<td>Electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linked zone</td>
<td>Catering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linked zone</td>
<td>Chemicals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linked zone</td>
<td>Biological</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Where possible mark severity of hazard on [Score 1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
2. Where control measure is effective, select "X" coded with applicable details.
3. Select the appropriate description for probability of exposure frequency & possible consequences from the adjacent nomogram.
4. Use the nomogram to estimate risk based on probability, exposure & possible consequences.
5. Where details of required control measures in the table are not available.

Risk Score:
- Very Low Risk
- Low Risk
- Moderate Risk
- High Risk
- Very High Risk

Details of required control measures to be filled in:
- Elimination or substitution of hazardous chemical(s)
- Engineering controls
- Administrative controls
- Personal protective equipment

Use of engineering controls to reduce duration of exposure:
- Isolation
- Local exhaust
- Ventilation
- Fume cupboard
- Other

Use of administrative or control measures to reduce duration of exposure:
- Local exhaust
- Ventilation
- Fume cupboard
- Other

Use of appropriate personal protective equipment (including type of PPE for each item):
- Gloves
- Containment
- Respirator
- Other

Implement required training.
RA – Using a Nomogram

Example: smoking in the stair wells

Leaking gas bottle, dropped winchester: unusual but possible
Naked flame: frequent  Consequences: serious  =>  High risk
RA – Chart SUVA

Consequence

<table>
<thead>
<tr>
<th>Kategorie</th>
<th>Schadenausmaß</th>
<th>Definition der Folgen</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>sehr gross</td>
<td>Tod</td>
</tr>
<tr>
<td>II</td>
<td>gross</td>
<td>schwerer bleibender Gesundheits schaden</td>
</tr>
<tr>
<td>III</td>
<td>mittel</td>
<td>leichter bleibender Gesundheits schaden</td>
</tr>
<tr>
<td>IV</td>
<td>klein</td>
<td>hilfsweise Verletzung mit Arbeitsauffall</td>
</tr>
<tr>
<td>V</td>
<td>gering</td>
<td>leichte Verletzung ohne Arbeitsauffall</td>
</tr>
</tbody>
</table>

Tabelle 2: Bestimmen des Schadenausmasses und der möglichen Folgen.

Probability

<table>
<thead>
<tr>
<th>Kat.</th>
<th>Definition der Wahrscheinlichkeiten W (Kerngröße)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>häufig</td>
</tr>
<tr>
<td>B</td>
<td>gelegentlich</td>
</tr>
<tr>
<td>C</td>
<td>selten</td>
</tr>
<tr>
<td>D</td>
<td>unwahrscheinlich</td>
</tr>
<tr>
<td>E</td>
<td>praktisch unmöglich</td>
</tr>
</tbody>
</table>

Tabelle 3: Wahrscheinlichkeiten W (Variante 1).

<table>
<thead>
<tr>
<th>Kontrast</th>
<th>Wahrscheinlichkeit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
</tr>
<tr>
<td>E</td>
<td>3</td>
</tr>
</tbody>
</table>

Abbildung 6: Beispiel einer Risikomatrix.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Große Risiken: Sicherheit nicht gewährleistet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 2</td>
<td>Mittlere Risiken: Sicherheit nicht gewährleistet</td>
</tr>
<tr>
<td>Zone 3</td>
<td>Kleine Risiken: Sicherheit grundsätzlich gewährleistet</td>
</tr>
</tbody>
</table>

Tabelle 4: Definition der Zonen.
3. Risk Control

In order of priority:
- Eliminate – stop doing it!
- Substitution – change solvents,…
- Modify process – use a different method
- Engineering controls – interlocks, fume cupboards,…
- Administrative controls – tag out
- PPE (PA) – gloves, masks
- Training – inductions, fire
- Personal hygiene – washing hands

“It’s ok… you just have to be careful!!”

Wrong!! Given time people will always make mistakes!
4. Evaluation / Monitoring

Risk assessments need to be reviewed:
- Changes in volume, process or control measures
- If ill health is reported
- Accidents or near misses
- New information on hazards
- Improved control technology is available
- At regular intervals to identify unnoticed changes

Records of all RA must be kept!

Long term health monitoring for:
- Asbestos
- Cadmium
- Radiation
- …
Accidents - reporting

- Very important for legal reasons
- Very important for spotting trends and potential future problems
• By law all chemical suppliers have to have MSDS
• Ensures chemicals used as intended
• Key tool for risk assessment
• Information to select appropriate safety equipment
• TWA, STEL, auto ignition temps, and lots more

http://www.msdssearch.com/
1- No-effect range (Safe region)
2- Range of increasing effect with increasing dose
3- Maximum effect range

PEL = TWA (8hr) or STEL (15min)

- **Carcinogens** – cause cancer
- **Sensitisers** – become allergic
- **Mutagens** - damage to the genes, heritable mutations, abnormalities in offspring: nicotine
- **Teratogens** – harm fetus, mother shows no toxic signs: ethanol

<table>
<thead>
<tr>
<th>Substance</th>
<th>LD&lt;sub&gt;50&lt;/sub&gt; (mg/kg, oral, rat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin C</td>
<td>11 900</td>
</tr>
<tr>
<td>Ethyl alcohol</td>
<td>7 060</td>
</tr>
<tr>
<td>Bromine</td>
<td>2 600</td>
</tr>
<tr>
<td>Osmium tetroxide</td>
<td>162 (mouse)</td>
</tr>
<tr>
<td>Nicotine &amp; salts</td>
<td>50</td>
</tr>
<tr>
<td>DDT</td>
<td>100</td>
</tr>
</tbody>
</table>

It says nothing about levels at which other acute toxic, but non-lethal effects might occur.
Dangerous Goods Code

33 = Petrol (Benzin)

- Bottom number is specific to the chemical (UN-number)
- Top number, 2-3 characters, 1st 2-9, 2nd/3rd 0-9

2 Gas 3 Flammable liquid 4 Flammable solid 5 Oxidising material 6 Toxic 7 Radioactive 8 Corrosive 9 Other
0 No meaning 1 Explosive 2 Evolves gas 3 Flammable 5 Oxidising properties 6 Toxic properties 8 Corrosive properties 9 Self reactive
Giftklasse

- CH Giftklasse has been replaced by EU chemical labelling code
- Giftklasse based primarily on oral toxicity, and other factors such as carcinogen
- Says nothing about reactivity, fammability etc
EU-Labelling

(F) Flammable
(F+) Extremely Flammable

(E) Explosive

(C) Corrosive

(Xi) Irritating, (Xn) Harmful

(O) Oxidising

(T) Toxic, (T+) Extremely toxic

Risk phrases (R) R1 Explosive when dry.

Safety phrases (S) S1 Keep locked up.
Laboratory Specifics – PPE

Clothing:
• Shoes
• Pants
• Clothing material
• Underwear… 😊

Long hair tied back… (Roland!?)
Safety Glasses

• Many styles… different level of protection ie splash proof, projectiles, full face shields
• “But I’m not doing anything”… NO EXCUSE!!
• Contact lenses – can concentrate vapours, become irremovable / hinder washing
• Corrective glasses – these are not safety glasses!
• On the face when you walk through the door
• Includes visitors to the lab – even Professors!
• Buy comfortable safety glasses!
• Problem with mixed lab / offices
Gloves

• Different types for different chemicals
• Break through time, mechanical strength, permeation rate
• Latex has pretty much the worst break-through time
• Basically useful for preventing contact with dry chemicals
• Nitrile, …
Fume Cupboards

- Sash height determines face velocity – only works below a specific height
- Make up air – windows, open doors etc
- Turbulence – walk ways, crowding
- All equipment ~10cm from front, held off the floor
- Alarmed for drop in flow
- Not for storage
- Tested for face velocity (meter), turbulence (smoke)
- Remember ours are not controlled, often don’t work: don’t trust them!
Cryogens

- Use full face shield – at least safety glasses
- Use gloves
- Dewars should have handles – “getting through the door problem”
Face masks

- You should not need one!
- If used, must be the correct type for the hazard
- Clean shaven
- Paper masks are useless! They do not seal adequately
Eyewash / Showers

- We don’t have any
- Hold lids open and flush 15min
- Problems with rubber hose – 2 eyes, hot water, not easily turned on, contaminated, missing…
- Contact lens problem

- Misconception: they are not for fire – “stop, drop, roll”
- Removal of spilled chemicals
- Be aware of electrical equipment in the corridors
Compressed Gases

- Always move with a trolley – with the safety cap on!
- Always attached to the wall – even when empty
- Use the correct regulator – oil + oxygen!
- Toxic gases stored in ventilated cupboards
General chemical hazard reduction

• Substitute whenever possible less hazardous materials
• Use as little material as possible
• Handle inside a fume cupboard
• Minimize contact with the use of PPE
• Read the MSDS before you use every new chemical
Storage

- Storage are labelled with contents
- Chemical should not be above shoulder height or crushing strength of containers
- >1L flammables should be in fireproof cupboard
- Fume cupboards are not storage areas – why?
- Store by compatibility – not alphabetically – why?
- Separation of risks – ie flammables and energy sources
- Avoid several layers deep
Personal view:

- Moral duty to your colleagues: the law is just the big stick
- Doing things “safely” is usually the slightly longer way – without constant supervision people will revert to the route with the least effort – human nature
- As long as you are never given the chance to do otherwise, the “safe” way becomes habit – get them when they are young!!!
- Demo!