Safety at Merck

EQ-E Division Merck KGaA

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The daily work could be...

dangerous!
What are the co-operation partners of a Safety Engineer?
Main duties of a safety specialist

- Support of the management and employees
- Support regarding the design of safe work places
- OHS training support
- OHS - Prevention
- Examination/Investigation of Incidents
Procedure of a Safety Specialist

- analyze
- evaluate
- setting targets
- propose measures
- define measures
- put into practice
- control efficiency of measures
- review & update
- define measures
What kind of hazards can be there?

What are the things a safety engineer is engaged with or where a safety engineer should be involved?
Merck Darmstadt
New raw materials for production enter Merck at Darmstadt
What do we have to take into account regarding incoming goods?

- Papers
- Labelling
- Condition of truck, packaging and goods
Next the goods will be stored in the warehouse via incoming goods department.
What problems can occur?

Ergonomic problems while unloading the truck:

Give support!
Safety aspects in storing the goods:

Protect the goods from weather conditions:
Groundwater protection

Ground sealing

Collection tray
Other OHS aspects in storing the goods:

- Fire Protection when storing flammable substances.
- Explosion Protection
- Fire extinguishing systems.

- Do not store flammable substances together with poisons

- Have separate footpaths in forklift areas
The substance has arrived at the production plant.

It will be used to manufacture a new product in a chemical process.
Safe work begins with the planning and designing of a plant.
Safety aspects in the production plant that have to be considered:

- Explosion protection
- Exothermal reaction $\rightarrow$ pyrolysis
- Plant safety: locking mechanisms, dosage, temperature regulation, fill-in / fill-out mechanisms, exhaustion, etc.
- Fire protection
- Training and instruction of staff
- Personal protective equipment and measures
Explosion Protection

The Danger Triangle

Inflammable material

Oxygen (from air)

Ignition source

bumm!
To install a proper explosion protection, one has to understand the properties of the three items:

- Inflammable material
- Oxygen
- Ignition source

and has to avoid at least minimum one of them.
Exothermal reaction → pyrolysis

- Avoid reaching the point of no return!
- Prefer using technical safety measures: locking mechanism, pressure resistant tanks, etc.

Disfunction e.g. interruption of cooling system
Training and instruction of the staff

- qualified/skilled employees
- regular practical and theoretical instructions
- before starting a new chemical reaction:
  - instruct the employees about hazards and dangerous substances!
- special trainings (e.g. explosion protection)
- special qualification / licenses (technical additives/tools like crane, forklift etc.)
Personal protective equipment and measures

- safety data sheets
- work instructions
- avoid exposure to dangerous substances
- exhaustion at points with exposure
- no contact → use personal protection equipments (resistance to the substance!)
Personal protective equipment and measures

Safe work ends with the personal protection.

Helmet
Gloves
Protecting shoes
Safety glasses
Protecting clothes
Personal protective equipment and measures

- Don’t forget maintenance

- Make sure that the plant is clean and free of chemicals!

- Cut every pipeline from the tank

- Make sure that there is no potentially explosive atmosphere

- Etc.

Reassure yourself first that there is no more hazard, then let the workers get started!
The quality of the new product has to be checked in the analysis laboratory.
Safety aspects in the laboratory:

Do you have?  
- Hygiene
- Emergency showers
- Free escape routes
- Safety data sheets
- Fume Cupboard
- Fire extinguishers

Do you wear?  
- Safety glasses
- Gloves
- Labcoats (with long sleeves)
- Closed solid shoes
Our new product is nearly finished now.
and is ready for packaging.
In the packaging area you can find several mechanical hazards!

- Moving parts
- Passing parts

Fingers or arms can be trapped in the machine. And in the worst case they being squeezed or cut off!
What is the best solution to prevent employees from being injured?

Separate hazardous parts of the machine from workers!

Stop the complete machine safely before repairs! Make sure that there is no possibility to restart the machine during repairs!
Å Ideal solution:

- A barrier with a locking system.
- If you open the cover, the machine will stop immediately.
- Now you can work inside without any risk.
Chemicals
Avoid exposure to toxic or dangerous vapours. Use exhaustion and/or capsule the machine.

Noise
Avoid too much noise. Capsule the machine if possible and/or give the workers ear-protection
Now our product is ready for sending to the customer.
Arrangement of the equipment

- screen laterally to the window
- enough space behind the chair (1m)
- avoid stumbling points, like cables, open drawers, etc.
- sufficient light
Ergonomics

Correct seating position:

- Look slightly down to the screen (35°)
- High backrest
- enough space for the legs (65 ï 70 cm)
- sitting frontally to the screen
- enough distance to the screen (45ï 80 cm)

Dynamics!

Best:
- 50% sitting
- 25% standing
- 25% moving
The packed and loaded product is leaving Merck now.
and will arrive soon at the customer.
Have you considered everything ???
... are you just lucky ????
Analyse the performance of work
Which steps are important?
Which hazards can occur? What may happen? Could anybody be hurt or properties damaged?
What are the targets to be achieved?
What kind of measures are necessary?
Pay attention to the “pyramid of measures”

1. Technical measures
2. Organizational measures
3. Personal protection equipment
Examples for hazards out of organizational problems

- Uninformed, untrained staff
- Lack of clear marked zones or missing hazardous labels/signs
- Hygienic problems
- Missing of regular checks and approvals i.e. for electrical tools
- Missing of fire protection measures i.e. no alarm plan i.e. no fire extinguishers i.e. no organization of first aid, etc.

Examples for hazards from ergonomic or social problems

- Poorly designed workplaces (to narrow, to dark, to hot or to cold)
- Handling of heavy loads
- Drug abuse
- Stress

analyze
Examples for mechanical hazards

- Cut, squash in or clamp in of arms, legs, fingers by contact with moving parts of machines or sharp edges
- Damage of eyes by flying objects (sparks, dust, shavings or parts of broken tools or broken work piece)

Examples for chemical hazards

- Fire, explosion, etching, swallowing or biological hazards

Examples for physical hazards or electrical hazards

- Hot or cold surfaces
- Noise pollution and vibration
- Radiation
- Defects on electrical equipments
Which hazards can be there?
Systematic study for hazards
Consider all operation-steps
When is it necessary to interfere with a machine in process with your hand?
Especially analyze steps for set-up process
Have also a look at the cleaning-procedure
What is about the noise?
What is about hazardous substances?
The term "Risk" is defined as:
- Hazard severity multiplied with probability
- Probability is the frequency of occurrence of a damaging event or injury

Risk Matrix

Hazard severity

Frequency of occurrence

Increasing Risk
### Hazard Severity

<table>
<thead>
<tr>
<th>Damage to persons</th>
<th>Environmental damage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S4</strong> Catastrophic (fatalities)</td>
<td>Above site limits</td>
</tr>
<tr>
<td><strong>S3</strong> Critical (serious injuries, irreversible effects)</td>
<td>Major damage to site</td>
</tr>
<tr>
<td><strong>S2</strong> Moderate (injuries, reversible effects)</td>
<td>Environmental damage in building / plant</td>
</tr>
<tr>
<td><strong>S1</strong> Low (minor injuries, no absence)</td>
<td>Negligible, limited to immediate location of incident</td>
</tr>
</tbody>
</table>
## Evaluate: Define Frequency

### Frequency of occurrence

<table>
<thead>
<tr>
<th>P4</th>
<th>Already happened to us several times (at least once a year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P3</td>
<td>Happened to us (once in 10 years)</td>
</tr>
<tr>
<td>P2</td>
<td>We already have a near-accident / already happened within the industry (once in 100 years)</td>
</tr>
<tr>
<td>P1</td>
<td>Can not be ruled out, although we know of no instance of it happening / have heard of it / globally (once in 1000 years)</td>
</tr>
<tr>
<td>P0</td>
<td>Reasonably not to be expected / never heard of an instance (once in 10,000 years)</td>
</tr>
</tbody>
</table>
## Risk Classes

<table>
<thead>
<tr>
<th>Risk class</th>
<th>Risk level</th>
<th>Risk-reducing measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Extreme, entirely unacceptable risk</td>
<td>Process or design change preferred</td>
</tr>
<tr>
<td>B</td>
<td>Very major unacceptable risk</td>
<td>Process or design change or a highly available protective system</td>
</tr>
<tr>
<td>C</td>
<td>Major unacceptable risk</td>
<td>Process or design change or protective system</td>
</tr>
<tr>
<td>D</td>
<td>Moderate, acceptable risk that should be further reduced</td>
<td>A good-quality monitoring system with documented checking, or a good-quality organizational measure</td>
</tr>
<tr>
<td>E</td>
<td>Minor, acceptable risk that could be further reduced</td>
<td>A monitoring system or organizational measure</td>
</tr>
<tr>
<td>F</td>
<td>Very minor, acceptable risk</td>
<td>None</td>
</tr>
</tbody>
</table>
### Risk Matrix

<table>
<thead>
<tr>
<th>Hazard severity</th>
<th>Frequency of occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>S4</td>
<td>0</td>
</tr>
<tr>
<td>S3</td>
<td>1</td>
</tr>
<tr>
<td>S2</td>
<td>2</td>
</tr>
<tr>
<td>S1</td>
<td>3</td>
</tr>
<tr>
<td>P0</td>
<td>4</td>
</tr>
<tr>
<td>P1</td>
<td>5</td>
</tr>
<tr>
<td>P2</td>
<td>6</td>
</tr>
<tr>
<td>P3</td>
<td>7</td>
</tr>
<tr>
<td>P4</td>
<td>8</td>
</tr>
</tbody>
</table>

The matrix evaluates risk based on hazard severity (S) and frequency of occurrence (P). Each cell represents a combination of the two factors, with ratings from A to E.
Example: machinery

setting targets

- Reduce number of working accidents or near misses
- Reduce idle times of the machine
- Reduce set up times
- Improve quality
Technical

- Coverings, rails or fences to prevent access to dangerous areas or to dangerous moving parts of machines or engines
- Safety sensors or switches to stop machines automatically, if covers are opened
- Emergency stop

Organizational

- Marks and safety labels
- Regularly training of the staff
- Regularly approvals

Personal protective equipment

- Safety shoes, gloves, goggles or protective clothing
Safety measures for equipment with rotating parts

Define measures

Example: machinery

The best solution:
Separate hazardous parts of the machine from workers!

Stop the whole machine safely before repairs. Make sure that there is no possibility to restart the machine during repairs.
Put into practice and control efficiency of protective measures

- Example for a protective enclosure for a blister machine
- Measure accidents, near misses, idle times etc.
- Benchmark
- Reassess the whole process on a regular basis
Thank you for your attention!