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Risk management in laboratory work

What is risk?

Some definitions:

A **risk** is the likelihood of ill health or accidents occurring and the consequences of this occurrence.

A **source of risk** is the cause of ill health or accidents. Sources of risk cannot always be eliminated but the risk can often be reduced.

A **chemical hazard** is a substance, or combination of chemical substances, that may entail ill health or accidents:

- because of its properties that are hazardous to health
- because of its temperature
- by reducing the concentration of oxygen in the air
- by increasing the risk of fire, explosion or other dangerous chemical reaction.

Differences between sources of risk and risks

Source of risk

Wrong protective equipment

Corrosive chemicals

Repetitive work

Needle

Risk

Exposure, crush injury

Corrosive injury

Repetitive strain injury

Needle-stick injury

Why should we perform risk management?

- To enhance employees' safety
- For preventive purposes, as part of systematic management of the work environment
- To provide good data for decisions
- To assist in prioritising activities
- To make communication of risks easier
- To compare different methods or techniques
- To facilitate induction of new employees
- To promote knowledge exchange and cooperation
- To meet legal requirements, e.g. in AFS* provisions:
 - AFS 2001:1 Systematic Work Environment Management
 - AFS 2011:19 Chemical Hazards in the Working Environment
 - AFS 2018:4 Smittrisker (Swedish) (Risk of infections)
 - AFS 2007:5 Pregnant and nursing workers
 - AFS 1997:7 Gases
 - AFS 2009:7 Artificial Optical Radiation
 - AFS 2005:15 Vibrations

**Translator's note*: the AFS series are provisions in the Code of Statutes issued by the Swedish National Board of Occupational Safety and Health.

When should risk management be carried out?

Examples of circumstances that call for risk management:

- Introduction of a new laboratory procedure
- Suspicion of accident risk or after an accident (accident investigation) or incident has taken place
- Changes in activities, e.g. introduction of new work procedures
- Investigations of CMR (carcinogenic, mutagenic or toxic for reproduction) effects
- Permit applications or work reports to various public agencies.

Whose duty is it to ensure implementation of risk management processes?

At Uppsala University, heads of department (or equivalent) are responsible for ensuring that risk management takes place. Heads of department (or equivalent) can in turn, with advantage, delegate the tasks involved to colleagues at the department (or equivalent) who are well informed about the laboratory operations to be risk-assessed.

Premises for risk management

When a risk management process is to be performed, it is advisable to consider the following questions:

- What can happen and why?
- What is the likelihood of the risks occurring?
- What are the consequences?
- Are there any factors that can mitigate the consequences or reduce the likelihood of the risk occurring?
- Is the risk acceptable or is action required?

Human–technology–organisation

It is important to take human–technology–organisation (HTO) interaction into account in risk management, since workplace accidents are usually caused by a combination of these factors. Applying the concept of HTO provides a better all-round view.

Human factors: attitudes; safety culture; current fitness.

Technical factors: according to work tasks and requirements, e.g. expertise.

Organisational factors: absence of rules; induction; training.

Risk management process

Risk assessment is a way of thinking ahead:

1. Planning and collecting information
2. Risk identification
3. Risk evaluation and prioritisation
4. Measures
5. Monitoring

Risk management

Written documentation is essential (a legal requirement).

Planning, collecting information

Before the risk management process starts, a plan of what is to be assessed, and in which order, must be drawn up. Choose a way of classifying activities. The classification may be based on, for example, premises, occupational categories or work operations. Group work, where possible, is preferable.

Each laboratory procedure, for example, should then be divided into stages. This is where the degree of detail for the whole process of risk management is determined.

It is advisable to start with the most dangerous work operations or handling of the most hazardous substances.

Collect information by examining, for example, safety data sheets for the chemicals handled; instructions on handling equipment and carrying out various work operations; protocols for safety inspections; and reports on any incidents and work injuries that have occurred.

Risk identification

At this stage, the focus must be on identifying risks. Postpone considering what action to take or how often something occurs: these stages come later.

Questions to include in the further risk management process

- Which hazardous properties do the substances handled have? Read the safety data sheet.
- How are the substances handled, and in what quantity?
- What equipment is used and can it cause accidents by, for example, crushing, falling, burning or repetitive strain?
- Who carries out the laboratory work — students or experienced scientists?
- Does the laboratory work involve operations in which one person works alone?
- Is there a risk of other workers being adversely affected by the work you perform in the laboratory?
- What happens in the event of a power cut and a ventilation shutdown?
- Are there draughts, noise and vibrations?
- What are the ergonomic characteristics of the laboratory work and is there a risk of repetitive strain injuries?
- How are the chemicals stored? Bear in mind the increased risk that combined storage may entail.
- Does the laboratory work involve risks for a pregnant woman or nursing mother?
- Are there any sharp needle-like or cutting instruments, such as needles and scalpels?
- Is work on biological and/or infectious material carried out?
- Is there a risk of developing an allergy?

Risk evaluation and prioritisation

Numerous possible risks are often identified. However, not all risks are equally serious. The purpose of evaluating risks is to estimate their degree of severity. Examples of questions posed in a risk evaluation may be which risks are tolerable and which must be remedied; which risks require immediate measures; and which measures can be inserted in an action plan pending their implementation.

Evaluate the risks identified, one by one, in terms of probability of an occurrence and its consequences. The scale used may vary, depending on the degree of complexity and type of risk assessment. A scale of three or five is normally used, with 1 given for the lowest probability or least serious consequence and 3 or 5 for the highest or most serious.

The following are examples of starting points in rating risk:

- How often is the risk considered to arise, and with what probability?
- What consequences for, for example, a person or activity does the risk entail if it arises?
- What cost does the risk involve?
- How significant is the risk in relation to other risks?

If it is difficult to determine the probability and consequences, the risk scale of low, medium and high may be used instead.

Estimation of the degree of severity of risks is subjective. The aim is to reflect reality as well as possible.

Risk rating

The probability level multiplied by the consequence level yields the risk rating of the event, which is often visualised by means of a risk matrix. Risk ratings culminate in an overview of the severity of risks and can thus serve as a basis for decisions on which measures to prioritise.

Measures

Measures should focus on risk elimination or reduction. Following implementation of risk assessment, an action plan should be drawn up on the basis of the risk assessment. Prioritise and plan measures according to degree of severity. Some of the measures may entail higher costs, which require planning in the forthcoming budget.

Measures should be applied as close to the source of risk as possible. Personal protective equipment is the last option, chosen if nothing else eliminates or reduces risk.

Examples of action

- Change of method.
- Substitution.
- Inspection of equipment, such as ventilation, fume hoods and draw benches.
- Review of the storage of chemicals.
- Relocation to a more suitable place (with better equipment, for example) to perform the laboratory work in.
- If possible, handling of chemical substances in closed systems.
- Inspection of personal protective equipment. Remember to use the right gloves and respirators for the substances handled.

- Review of signage and labelling.
- Review or development of routines for waste management and adaptation of waste management to make it safe.
- Development of work instructions or routines that are intelligible to everyone who performs laboratory work.
- Induction of new employees.
- Regular review of emergency equipment, such as eyewash fountains and emergency showers.
- Sourcing of remediation and decontamination materials containing, for example, absorbent substances.
- Communication to others working in the surroundings about the experiments that are under way. Is there any exposure risk for other workers at the laboratory?
- Review of the work organisation.
- Training.
- Review of the division of responsibilities.

Monitoring

An assessment of what constitutes a sufficiently safe work procedure is not permanent. The risk management process therefore need to be monitored regularly (at least once a year, in the event of changes or after an accident or incident). What has once been found to be an acceptable risk may not, perhaps, be considered acceptable today.

The following questions may serve as a basis for following up action and monitoring risks in the work environment:

- Did the measures taken have the desired result?
- Have the risks of ill health, injuries and accidents decreased to an acceptable level or been eliminated?
- Do the measures work well in everyday work?

- What do those affected by the measures think of them?
- What is required for the measures to continue working well?

More information

Swedish Work Environment Authority: <https://www.av.se/en/>

Prevent ('Scandinavia's leading provider of knowledge and training in the field of health and safety'):

<http://www.prevent.se/om-prevent/in-english/>

In Swedish:

www.prevent.se/kemiguiden

Centers for Disease Control and Prevention (CDC): NIOSH
Pocket Guide to Chemical Hazards

<http://www.cdc.gov/niosh/npg/default.html>

UK Health and Safety Executive: Working with substances
hazardous to health

<http://www.hse.gov.uk/pubns/indg136.pdf>

International Organization for Standardization: SS-ISO
31000:2009 Risk management — Principles and guidelines

http://www.iso.org/iso/catalogue_detail?csnumber=43170