Good Practice for Enhancing Process Safety

tukes

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Finnish Safety and Chemicals Agency

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Introduction

The Finnish Safety And Chemicals Agency (Tukes) monitors the safety of large-scale chemical plants in Finland. The aim is safely operated chemical plants that are proactive in their development of safety issues, and able to predict and prevent safety problems. In other words, Tukes aims to encourage chemical plants to manage their process safety issues effectively.

The aim of this guide is to assist chemical plants to better manage safety-related issues. The first section summarises the supervision of chemical plants carried out by Tukes. The second part lists practical examples of how to manage safety issues. The examples are based on experiences at chemical plants which have received good grades from periodical inspections by Tukes.

This guide is based on Tukes publication 1/2012:"Authority supervision of chemical plants in Finland" (*in Finnish*). The publication is a study in which inspection reports from periodical inspections of chemical plants supervised by Tukes from 2006 to 2011 have been used as data.

Tukes aims to encourage chemical plants to manage their process safety issues effectively.

Part 1:
Supervision of Chemical Plants

Supervising the safety of chemical plants is a statutory task carried out in Finland by the Finnish Safety and Chemicals Agency (Tukes). There are approximately 700 chemicals and explosives establishments under the supervision of Tukes that use chemicals on a large scale. Supervision consists mainly of periodical inspections of chemical plants. These inspections are conducted either annually, every three years or every five years, depending on the amount and classification of the chemicals.

This section introduces the supervision carried out by Tukes. The aim is to explain how Tukes classifies chemical plants, on what basis the frequency of each periodical inspection is determined, and what the numerical grades reveal about the level of safety at a chemical plant.

Classification of chemical plants

CHEMICAL PLANT OPERATIONS are divided into two groups depending on the amount and classification of the chemicals at the plant: large scale and small scale. The more dangerous chemicals there are at a plant, the more investigations are required to show that they operate safely. The supervision of large-scale chemical plants is the responsibility of Tukes, whereas the supervision of small-scale plants is the responsibility of the relevant local rescue authorities.

The handling and storage of dangerous chemicals classified as large scale is subject to a licence, which is granted by Tukes.

Chemical plants classified as large scale are divided into three categories according to legislative obligations:

1) **UPPER-TIER ESTABLISHMENTS**: Operations require a chemical Safety Report in order to be granted a licence; inspected annually.
2) **LOWER-TIER ESTABLISHMENTS**: Operations require a Major Accident Prevention Policy in order to be granted a licence; inspected once every three years.
3) **NATIONALLY REGULATED ESTABLISHMENTS**: Operations subject to a National Licence; inspected once every five years.

The inspection frequency depends on the scale of operations at a plant. Inspections can be carried out less frequently if a plant is well-managed according to regulations. On the other hand, inspections can be performed more frequently if necessary in order to ensure safety.

CLASSIFICATION OF CHEMICAL PLANTS ACCORDING TO THE AMOUNT OF DANGEROUS CHEMICALS

	AMOUNT AND CLASSIFICATION OF CHEMICALS			
	LARGE-SCALE HANDLING AND STORAGE (TUKES)			SMALL-SCALE HANDLING AND STORAGE (LOCAL RESCUE AUTHORITIES)
SCALE OF OPERATION	Upper-tier establishments	Lower-tier establishments	Nationally regulated establishments	
INSPECTION FREQUENCY	1 year	3 years	5 years	

TUKES CARRIES OUT periodical inspections at the plants under its supervision. These help ensure that a plant has taken every precaution to prevent accidents. The safety of a plant is assessed both qualitatively and quantitatively. An inspection report is compiled containing both a written assessment and a graded evaluation of the plant. These assessments affect the frequency of the periodical inspections.

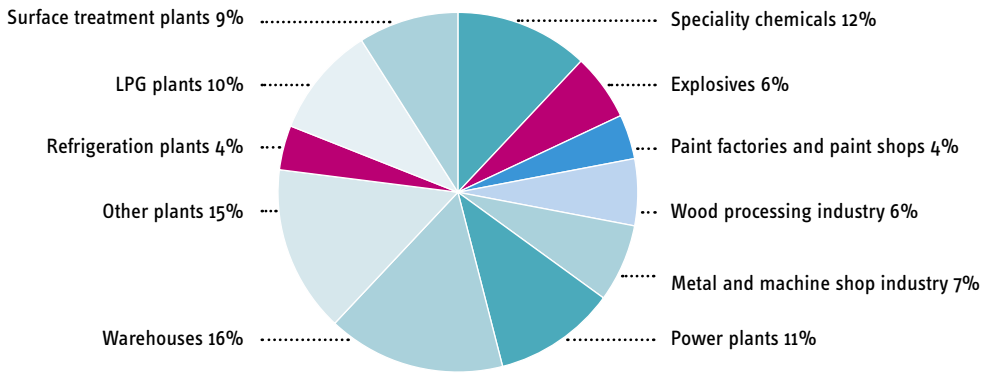
Standard industrial classification

The chemical production plants under Tukes's supervision are divided into 11 different industrial classes.

These classes comprise:

- Paint factories and paint shops: paint production, car and washing chemical production, and the mixing of chemicals without actual chemical reactions
- Refrigeration plants: facilities that use ammonia
- LPG plants: storage and handling of LPG, including aerosol production
- Power plants
- Surface treatment plants: surface treatment and impregnation
- Wood processing industry: pulp and paper industry along with further processing of chemicals
- Speciality chemicals: chemical plants with actual chemical reactions
- Metal and machine shop industry
- Explosives: production and storage of explosives
- Warehouses: warehouses for liquids and solids (containers and single consignments)
- Other plants

PLANTS UNDER TUKES'S SUPERVISION ACCORDING TO INDUSTRIAL CLASSIFICATION (2011)



Assessment of chemical plants

During the periodical inspections, Tukes assesses plant operations in seven different areas:

1. Awareness of regulatory requirementss
2. Management and personnel commitment
3. Risk assessment and decision-making
4. Technical implementation and functionality
5. Instructions for and assessment of operations
6. Competence and training
7. Managing emergencies and deviations

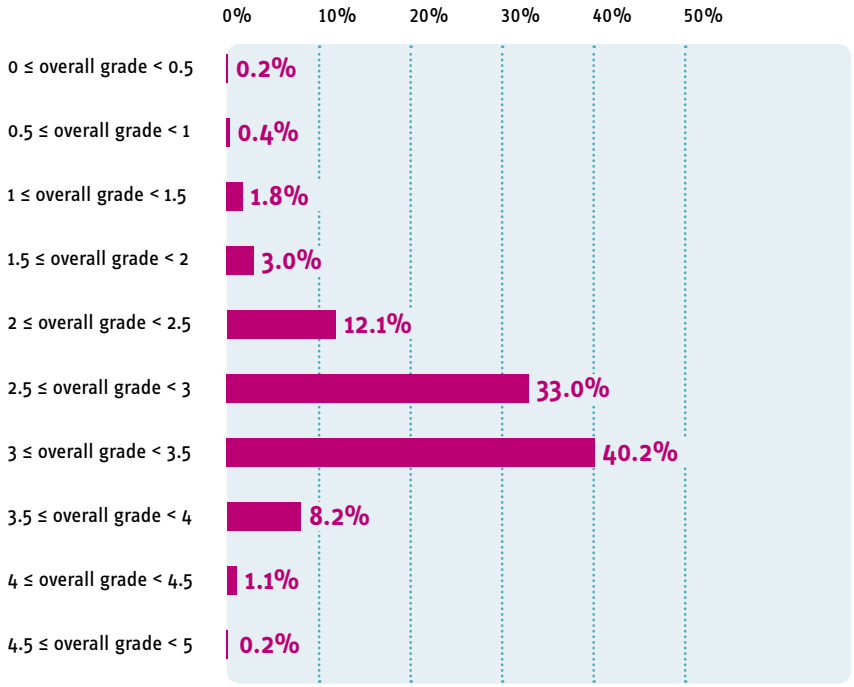
Each of the seven areas is assigned a grade (0-5) based on the inspection findings. Grades of 3 and above indicate that safety management at the plant is in accordance with the regulatory requirements. Grades below 3 indicate that plant safety management does not meet the statutory requirements in all aspects. Grades can also be assigned with half-point intervals (e.g. 3.5).

NUMERICAL RATING SCALE FOR PERIODICAL INSPECTIONS

5	BEST PRACTICES	Encouraged to continue proactive development.
4	GOOD PRACTICES	Positive features identified.
3	MEETS LEGAL REQUIREMENTS	Possibilities for development emphasised.
2	REQUIRES IMPROVEMENT	Advised, urged to improve.
1	SIGNIFICANT DEFICIENCIES	Swift action required.
0	SEVERE DEFICIENCIES	Immediate action required.

TUKES PUBLICATION 1/2012 "Authority supervision of chemical plants in Finland" includes a study of the safety level of chemical plants under Tukes's supervision based on their grades. In the study, the overall grade of a plant was calculated as the average grade in all areas. The data took account of the grades from the latest periodical inspection of chemical plants. The diagram below illustrates the distribution of the overall grades. The majority of plants received an overall grade between 3 and 3.5.

OVERALL GRADES FOR CHEMICAL PLANTS

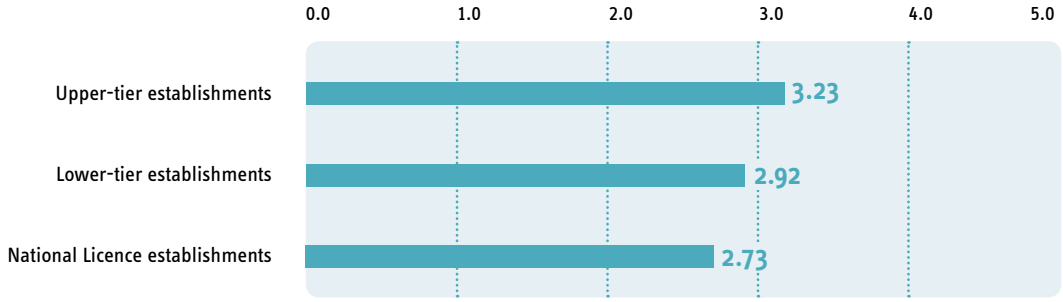


Part 1: supervision of chemical plants

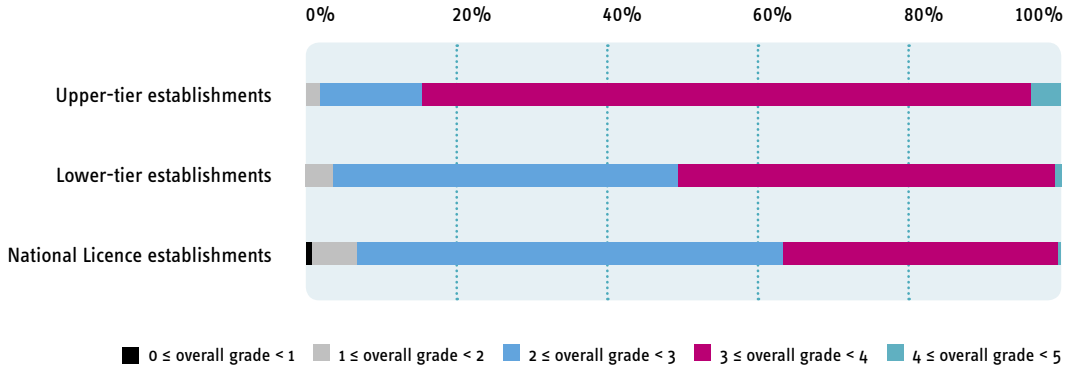
The study also analysed the data according to the extent and field of operations. The conclusion was that they had an effect on the safety management level of the plant. The diagrams on this page show that the upper-tier establishments have the best safety management level. Establishments in the other two categories had the most room for improvement.

The highest grades were given to establishments producing and storing explosives, chemical production plants, and pulp and paper mills. According to the study, the most room for improvement was discovered at refrigeration plants, surface treatment plants and LPG plants.

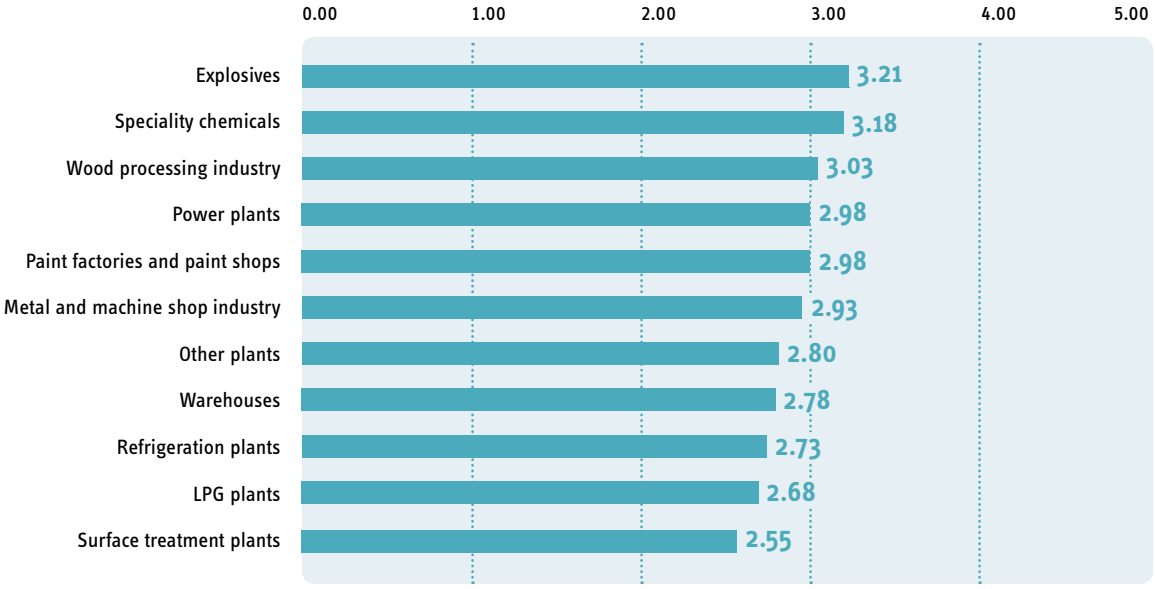
Overall grade averages according to the extent of operations



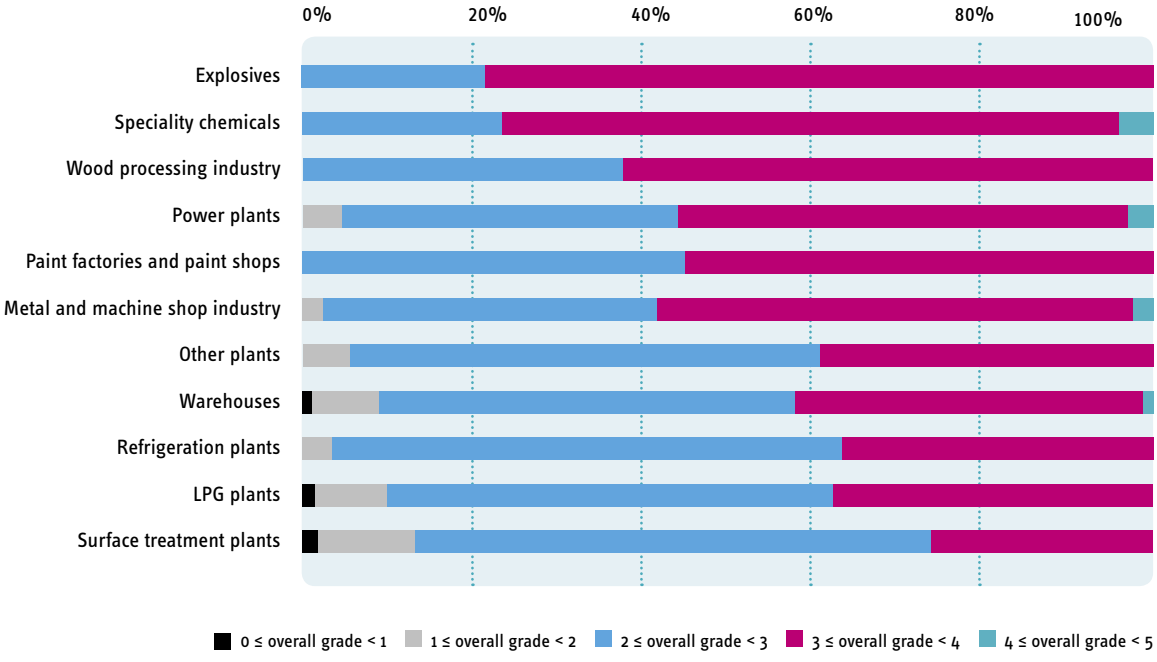
Grades according to the extent of operations



OVERALL GRADE AVERAGES ACCORDING TO THE EXTENT OF OPERATIONS



GRADES ACCORDING TO THE FIELD OF OPERATIONS



Part 2:
GOOD PRACTICE

This section provides details on the issues that Tukes focuses on during periodical plant inspections. The inspections are based on an inspection programme by Tukes, which consists of seven different areas of evaluation. The programme is sent to companies prior to the inspection.

The section briefly describes what is assessed within the seven programme areas in practical terms. Examples of good practice have been collected from the inspection reports for plants that have received good grades. The examples do not constitute evaluation criteria for Tukes as such, but are meant to be applied by companies when developing their safety practices.

When applying good practices, one should consider that they are not necessarily transferable as such from one environment to another. The suitability of a good practice must be considered beforehand to ensure that it doesn't pose new risks. When a particular practice suits a company's needs and is working well at that company, the practice constitutes a good practice.

1 Awareness of regulatory requirements

INSPECTORS ASSESS: How well has the establishment recognised its legal obligations? How are the changes to these obligations monitored?

In order for a company to fulfil its statutory obligations, it must be familiar with the legislation related to its operations. It is essential for good compliance with regulatory requirements that the legislation related to operations is monitored regularly, and that this task is carried out by appointed members of staff.

Examples of good practice:

- Use of Tukes's press release distribution list to monitor legislation. The distribution list provides information on changes in legislation related to Tukes's field of operations, among other things. It is possible to subscribe to the distribution list via Tukes's website.
- Use of a regulatory information service providing guidance on how the law can be applied to a company's operations.
- Registering all comments by authorities and the resulting actions in one system to facilitate access to up-to-date information.

2 Management and personnel commitment

INSPECTORS ASSESS: Are management and staff committed to safety issues? What methods does the management use to maintain, assess and improve the level of safety?

When management and personnel are committed to safety, the latter is seen as an integrated part of the organisation's performance as well as an important issue throughout the organisation. In a committed culture, safety is regarded as important both at work and during leisure time.
This commitment is enhanced if a company has clear and concrete safety targets that have been embedded in the everyday operations. Targets should be monitored actively to ensure that they are realised.

An essential factor in gaining personnel commitment is the degree of interest that the management demonstrates towards safety. One way for management to advance safety is to take part in safety tours.

Communication also plays a significant role in committing personnel to safety. It has to be open and information should be readily accessible to everyone. It is important for the personnel to be able to monitor safety indicators and the progress of actions and initiatives related to development. Everyone should have the opportunity to influence safety. In addition to in-house staff, external service providers should also be taken into account in safety issues.

Part 2: good practice

Examples of good practice:

Safety communication

- Safety issues are the first item on the agenda in all meetings.
- Safety meetings (e.g. short meetings on current safety issues) are held regularly.
- Safety weeks are organised, including process safety and health-related training.
- Awareness of safety-related issues is raised with the help of safety themes, changing monthly or annually.
- A safety video is produced, introducing the chemicals in use at the plant, their attendant risks and the action that needs to be taken in the event of an emergency.
- Practical comparisons are made on the way in which safety issues are organised between departments, branches and companies within the same sector.
- Information is communicated about previous accidents with the help of accident report cards, which contain a summary of the accident with key points illustrated. The cards are accessible to everyone and handled in safety meetings, for example. The cards are also used when planning work, as well as in risk assessment and training.
- Safety issues and instructions are communicated via info screens.
- Safety issues are raised via paper leaflets distributed on canteen tables, for example.
- A safety notice board is maintained with information on safety targets, indicators and previous accidents.
- Shift handover meetings are held, during which any deviations occurring during the previous shift are discussed.
- Regularly updated bulletins on current safety issues (e.g. use of reflectors, international accidents) appear on the intranet landing page or similar internal communication channels.
- Operations supervisor meetings are held.

Employee participation

- A development group for safety issues is established, consisting of employees only. A budget is allocated for the group to carry out improvements with immediate effect.
- Local chemicals supervisors are appointed in addition to the mandatory operations supervisors.
- Observation tours are conducted for new employees.
- Safety programmes are put in place for each department.

External employees/visitors

- Safety training is implemented for external employees, after which each participant is issued with a picture ID card.
- External employees are required to take an exam on orientation material and/or to acknowledge that they have familiarised themselves with it against a signature.
- Safety aspects are taken into account when making service agreements.
- A safety guide for visitors is launched.

Monitoring and documentation

- Regular observation tours are conducted by different levels of the organisation.
- Various form templates are created for reporting different deviations (e.g. near-misses, accidents, environmental damage, leisure-time accidents).
- Service providers are taken into account in accident statistics.
- Leading safety indicators are used and developed.
- Process safety indicators are developed.
- Deviations are entered into and monitored by an ICT system, including information on the processing phase of the deviation, the person in charge and the required corrective/preventive actions. Persons in charge are notified if the actions are not registered as completed by an agreed date.

Rewards

- The reporting of near-misses is encouraged (e.g. by handing out meal vouchers).
- Staff are rewarded for an accident-free period (e.g. with coffee and cake).
- The realisation of safety targets is linked to productivity bonuses.
- An ‘Employee of the year’ award is introduced for actively promoting safety.

3 Risk assessment and decision-making

INSPECTORS ASSESS: How has the company assessed the chemical and process risks related to its operations? How are safety issues taken into account in decision-making?

Identifying dangers and risks should be a proactive process, integral to the company's everyday operations. Employees are encouraged to actively identify risks and report any observations. Good practice exists when risk assessments are updated regularly, and immediately when necessary, for example in connection with changes. It is also recommended that several different methods are applied in risk assessment, with the most suitable method being selected depending on the purpose. Risk assessment results must be taken into account in decision-making. Good risk assessment covers all plant operations and is also expected of service providers.

Examples of good practice:

- Information on deviations is distributed between different sites. Based on this information, other sites consider whether a similar situation could occur at their site and whether they are prepared.
- A schedule/watchlist for risk assessments is created to indicate when different risk assessments have been carried out.
- Unusual weather conditions are also taken into account in risk assessment.
- Employee interviews are exploited to the full when performing risk assessments.
- Risk assessments are carried out in a project group consisting of representatives from planning, production, maintenance, and management.
- Risk assessments are performed on individual tasks and/or pieces of machinery/equipment.
- A risk assessment is always carried out (e.g with the help of a checklist) before starting a task.
- Risk assessments are reviewed after every deviation.
- Instructions are compiled on how to implement changes. A risk survey is carried out before making any changes.
- In addition to work safety, process safety is also taken into account in risk assessments.

4 Technical implementation and functionality

INSPECTORS ASSESS: How is the functionality of appliances and equipment ensured at a company? How is their reliability monitored and inspected?

When maintaining the functionality of a plant or piece of equipment, it is important that the plant has an up-to-date maintenance plan and that its implementation is documented. Maintenance should be preventive. Safety requirements must also be taken into account at the equipment acquisition and planning stages. It is also important to utilise any results gleaned from maintenance and inspections in order to improve operations.

Examples of good practice:

- A maintenance programme is created to help perform preventive maintenance.
- Equipment is classified according to importance and operations so that safety-critical appliances and equipment can be identified. Maintenance and inspections are carried out according to the classification.
- Safety systems and automation are tested regularly.
- Weekly meetings are held in relation to the maintenance system. These assist communication between the plant and those responsible for maintenance.

Maintenance should be preventive.

5 Instructions for and assessment of operations

INSPECTORS ASSESS: What instructions does the company provide for the safe operation of the plant? How are emergencies and deviations taken into account in the instructions?

Safety can only be advanced if instructions for the safe performance of work tasks are in place. Likewise, everyone working on the company premises must be introduced to safety procedures. It is crucial that agreed procedures and instructions are followed and any deviations are actively addressed. In order to maintain safety, it is important that procedures and instructions are reviewed and updated on a regular basis.

It is crucial that agreed procedures and instructions are followed.

Examples of good practice:

- Safety-critical equipment is identified and work instructions and maintenance in relation to this equipment are defined.
- Process safety is acknowledged as a separate entity.
- Double locking is used during alteration work and maintenance. For example, the safety coupling can be locked and the key put in a drawer which is locked by the maintenance staff with their own keys. Once the work is done, the maintenance staff remove their lock. The key cannot be taken out until all the locks have been removed. This ensures that the process is not started accidentally during alteration or maintenance work.
- Employees are consulted when compiling work instructions in order to verify whether the work can be carried out in the way described.
- Work instructions are issued to employees against a signature.
- A list of questions is attached to the work instructions to help employees check whether they have understood everything correctly.
- Employees are requested to explain what they are doing and why. This helps ensure that the employee is familiar with the instructions and understands why it is important to perform the work in accordance with them.
- In addition to the safety datasheet, a separate first-aid guide is compiled with regard to the most dangerous chemicals.
- Audits are organised during which employees can observe each other's working methods.
- Instructions are handed to service providers, such as drivers at the gate, requesting them to confirm against a signature that they have read and understood the instructions. In addition, instructions are compiled in several languages.

6 Competence and training

INSPECTORS ASSESS: How are staff familiarised with process safety issues? Are service providers taken into account? How is competence maintained?

Acquiring an understanding of safety issues requires that new employees and service providers are well-trained. Refresher courses and further training should be arranged for existing employees as well.

One way of taking care of staff training is to maintain a training plan and to monitor its progress. It is good practice to include service providers in the plan as well. It is also important to support competence-based training and training related to the development of work tasks.

Examples of good practice:

- The length of the orientation period is adjusted according to the task.
- Long absences are acknowledged in orientation practices.
- Staff training is carried out before extensive modification work.
- A training register is maintained.
- Training is a company-wide process.
- Written exams are administered to ensure that the training has been effective.
- Information from the training sessions is shared throughout the organisation.

7 Managing emergencies and deviations

INSPECTORS ASSESS: What procedures does the company have in place in the event of emergencies and deviations?

It is essential that staff know how to act during emergencies. For this reason, regular training in emergency procedures should be arranged. It is also recommended to include service providers in the training sessions.

Staff and service providers should be encouraged to report near-miss situations. These reports help when it comes to identifying risks and determining what action should be taken where necessary. Potential accident scenarios should be investigated and the resulting data used to improve operations.

Examples of good practice:

- A fire-drill group that trains weekly is formed.
- Department-specific fire drills are organised.
- An event is arranged where feedback on the success of an emergency drill is given. The drill is documented.
- A team of fire-fighters is maintained at the plant.
- Safety devices are tested and inspected regularly (e.g. safety lighting, safety showers, emergency eye-wash fountains).
- A 'chemical map' of the plant is created, including the location of chemicals, exits and fire extinguishing equipment.
- Container-specific extinguishing instructions are compiled.
- Close cooperation with the rescue services is maintained.
- Fire drills are arranged for all rescue service shifts.
- Rescue services from nearby regions are also included in the drills.

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