ENSURING SAFETY AT A PESTICIDE MANUFACTURING PLANT THROUGH EFFECTIVE MAINTENANCE

1 General information

Country: Hungary.

Available language: English.

The **sector covered** in this case study is manufacture of chemical pesticides.

Tasks covered: handling chemicals, manufacturing, processing materials.

Worker groups covered (vulnerable groups): maintenance workers.

The **purpose of this example of good practice** was to raise awareness, and to improve risk assessment and training.

The **target groups** are workers, workers' representatives and supervisors.

2 Initiator/organisations involved

KISCHEMICALS Manufacturing and Mercantile LLC (KCH).

3 Description of the case

3.1 Introduction/background

Biological agents: none.

Hazard — physical state: not applicable.

Hazard — health effect: allergens, asphyxiants, irritants, neurotoxic substances, toxic substances.

Exposure route: inhalation, skin absorption, dermal contact.

Substance description (CAS/EC) (only if possible): chlorine (7782-50-5/231-959-5), phosgene (75-44-5/200-870-3), carbon-monoxide (630-08-0/211-128-3).

The company was established in 1950 to manufacture ammunitions. Later, it switched to the manufacture of pesticides and chemical intermediates. After privatisation and a reduction in market share, the company was re-launched in 2008. The current portfolio of the company includes superactive pesticides and isocyanate intermediates, namely thiolcarbamates, urea herbicides, chlor(thio)formats and acidchlorates. The production process requires the use of very dangerous substances such as carbon monoxide, chlorine, ammonia and phosgene. The changing market demands were addressed by multi-product manufacturing, which enables rapid changes in production from one product to another. The plant employs around 180 workers and operates 24 hours a day, 7 days a week. Technological developments and major maintenance activities are carried out partly by subcontractors.

3.2 Aims

Safe operation is crucial in this sector, and maintenance was identified as a key component of achieving the uninterrupted running of the plant. Maintenance work may expose workers to any substance used in the manufacturing process (including intermediary substances). The following materials were of particular concern for the company's management: chlorine and phosgene (highly toxic liquids/gases),

corrosive intermediate chemicals, carbon monoxide (a colourless, odourless, flammable asphyxiating gas) and the variety of solvents used (flammable and may explode). Risk assessment revealed that the most hazardous activity is the maintenance (opening) of pipes in which the above chemicals may be present (e.g. as residues). One of the company's priorities is to minimise the risk associated with unplanned stoppages and situations hazardous to workers, to inhabitants of the vicinity of the plant and to the environment. The management decided to focus particularly on the development of safe working habits throughout the company.

3.3 What was done and how?

The company addressed the issue of maintenance in several ways. The daily management of machinery provides a firm basis for effective maintenance. Critical equipment is also checked weekly. Audits within the company provide the inputs required to set targets. Maintenance tasks can be carried out only upon authorisation. The manager responsible for environment, health and safety (EHS) participates in weekly technical meetings.

3.3.1 Change management

The maintenance cycle of the equipment is managed using spreadsheets. Any malfunction is noted and the repair required is recorded. Therefore, it is easy to trace the specificities of any machine part that has been added.

If there is a need for a change or repair to equipment, the staff member concerned starts a change request; the managers responsible (managing director, technical manager, production manager, environmental health, safety and quality (EHSQ) manager, technologist and, if necessary, other professionals) decide whether or not to accept the change request and the priorities of the associated tasks. They designate a project manager, who is responsible for involving any relevant professionals. When the work is complete, details are fed into the system and the plant operator concerned can see that the issue has been solved (feedback).

Several plant parameter booklets have been replaced by spreadsheets, e.g. the laboratory enters the results of sampling electronically and the plant operator can see it immediately. The company plans to introduce industry solutions software in the coming years.

3.3.2 Critical machinery

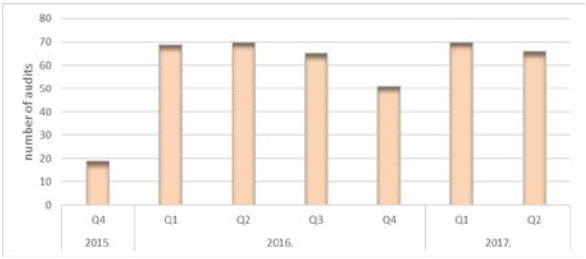
Equipment that is characterised by its high hazard potential (e.g. the mechanical seals of dangerous vessels and pumps), are monitored weekly. These regular checks enable the timely detection of even tiny problems. Hazardous malfunctions and unintended stoppages of machinery can be prevented by the anticipated and scheduled replacement of worn-out parts.

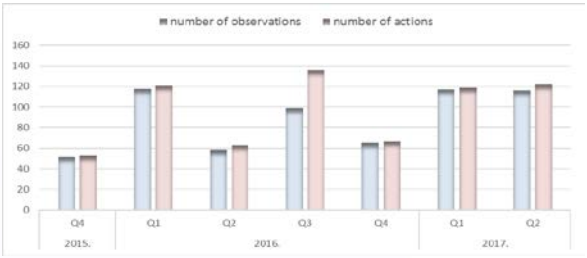
3.3.3 Internal audits

The company performs monthly internal audits. First-level audits are carried out within a unit and are led by the local manager and guided by checklists. During cross-audits (second level), units audit other units and, thus, provide a fresh perspective. Third-level audits are led by the managing director. Inspections by relevant authorities are also classed as third-level audits. The internal audits are guided by a spreadsheet (supported by a guideline) designed for non-EHS professionals. The output is a complex adequacy indicator and is used to set targets. It includes a list of inadequacies and deadlines that is sent to the EHS manager. The results of these audits are linked to bonuses. By reporting their own non-compliance events, plants can collect bonus points. This promotes plant-level EHS awareness. If any non-compliance is spotted by higher level audits/inspections, the plant receives malus points with a higher multiplication factor.

Many audits were conducted in the first half of 2017 and they may result in several actions, even for minor observations (Figure 1). Many of the actions taken as a result of these audits were preventive (no malfunction or risk was present).

Figure 1. Audits and observations between Q4 2015 and Q2 2017





3.3.4 Company regulation for maintenance

In order to improve the safety culture of subcontractor companies, the company EHS team paid special attention to subcontractors, with repeated communication of safety information, training sessions and the supervision of the entire work area. This approach was extended to KCH's own employees. The company issued a standalone internal regulation for maintenance. Daily maintenance is subject to authorisation.

The working conditions of contractors (training, documents, medical check-ups), the process of work permitting and the supervision of contractors have been regulated by 'Access and employment rules' since 2016 (Figure 2). Maintenance manuals were developed by the mechanical and electrical maintenance provider and the technical team of KCH. These manuals detail the process for the maintenance of the equipment/area and also the EHS rules associated with these activities. If the company risk assessment document indicates a risk of fire/explosion or work in a confined space, the contractors can start working only after permission has been granted. The shift managers issue the work permits for contractors and define the necessary personal protective equipment and other precautions based on the internal EHS regulations. For example, when maintenance is to be carried out where there is a risk of chlorine, phosgene or carbon monoxide exposure, the permit is given to the subcontractor only after the area has been monitored with a portable handheld gas monitor immediately before the start of the work. The same applies to work carried out in confined spaces (e.g. tanks, where oxygen levels may be too low). The oxygen-level monitor is left in place to alert the worker of a decline in oxygen levels in time. There are standard rules of procedure for sectionalising and vacating pipelines. When flammable liquids may be present, the risk of sparking must be eliminated. The shift managers are trained regularly on these rules of procedure.

Figure 2. Contractors can learn about the EHS requirements of KCH.

3.3.5 Integration of EHS and maintenance into management practices

EHS is taken seriously at KCH, as confirmed by the presence of the manager responsible for EHS at weekly technical meetings. EHS and maintenance are mainstreamed into management from the planning phase and the opinions of EHS staff are given attention. This can result in substantial decisions with important consequences. For example, the EHS department recommended obtaining a statement from the relevant authority; in another case, a technical process was modified and a component was placed outside the working area in order to protect workers; and, on one occasion, the EHS department reached the conclusion that only a closed system would be safe and, thus, an entire project was abandoned, because the costs of building a closed system were deemed too high.

3.3.6 Event investigation

A very efficient event investigation system is operated by the EHS department. They define the root cause of minor technological or EHS events with the help of technical professionals and try to reduce future problems with preventive actions. The plant units detail technological problems/failures in failure report files and save these on the internal network. The technical department adds the names of the persons responsible and the deadline for resolution to the report titles. In addition to this, the shift managers inform the managers responsible by email of every deviation from normal operation. Based on these reports, the relevant staff can select cases that need to be investigated.

3.4 What was achieved?

Before the introduction of the new audit system and the supervision of contractors, the number of accidents was higher. In fact, in the last year, no accidents among contractors have occurred.

In the last 2 years, the EHS culture in KCH has been enhanced. New methods and new systems have been introduced. KISCHEMICALS encourages employees to be more safety conscious in their work. The main activities that have led to the company achieving this improved safety culture are:

- more conversation with employees about their ideas and problems;
- more plant visits and investigations at different stages;
- more non-compliance reporting from the site (as a result of the bonus-driven motivation system);
- more attention paid to housekeeping (dedicated persons are now responsible for housekeeping);
- more preventive actions initiated;
- more change requests;
- new EHS projects are in progress;
- new safety information boards and cards at the site;
- workers have acquired some systematic approaches and are more prepared for the planned digitisation of systems.

3.5 Problems faced

In some cases, major problems were caused by the long-standing improper habits of employees, so here was an urgent need for a change in the safety culture. The use of newly introduced software tools was strange for some employees (custom-made software using Excel spreadsheets instead of a traditional paper and pencil parameter booklet, etc.), The company overcame this by regular training sessions, which helped employees to understand the benefits of using the new system. In addition, the new information and rules were built into an 8-hour complex training programme for employees.

3.6 Success factors and challenges

The following factors contributed to the success of the measures:

- Management commitment: the introduction of the new system was supported by the managing director and the rest of the KCH management team. They decided to refresh the whole process regulation system and define goals to make the operation more efficient.
- Workers' participation: the management communicated these goals to employees and introduced the changes to the process regulation system through team work.

3.7 Transferability

The approach is transferable to any company, not only to those that use hazardous technologies.

The methods used could apply to any small or medium-sized enterprise and cause positive changes in their operation.

3.8 Costs and/or economic impacts

The introduction of the changes did incur extra costs, but these costs have continuously decreased since the company started to implement the new system. Further cost reduction is expected with the development of the maintenance system, e.g. by introducing different types of information technology solutions (software, etc.).

3.9 Evaluation

The case study:

- is transferable to other companies/sectors/countries;
- focuses, where possible, on preventing risks at source;
- includes all relevant parties, especially those who will be affected by the actions;
- comes from a credible source;
- does not include/contain advertisements;
- represents a realistic work situation;
- provides a contact for further information.

3.10 Further information

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