European Week for Safety and Health at Work 2003

European Agency for Safety and Health at Work

The practical prevention of risks from dangerous substances at work

European Week for Safety and Health at Work 2003

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In order to encourage improvements, especially in the working environment, as regards the protection of the safety and health of workers as provided for in the Treaty and successive action programmes concerning health and safety at the workplace, the aim of the Agency shall be to provide the Community bodies, the Member States and those involved in the field with the technical, scientific and economic information of use in the field of safety and health at work.

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A great deal of additional information on the European Union is available on the Internet.
It can be accessed through the Europa server (http://europa.eu.int).

Cataloguing data can be found at the end of this publication.

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Contents

1.

INTRODUCTION

Background

Dangerous substances are found in many workplaces. Around 16% of workers in Europe report handling hazardous products and 22% are exposed to toxic fumes and vapours for at least a quarter of their working time[1]. Exposure to dangerous substances can occur anywhere at work, on farms, in hairdressers' shops, in motor-vehicle repair shops, in hospitals, at chemical plants.

Dangerous substances can cause many different types of harm. Some cause cancer, others can affect the ability to reproduce or cause birth defects. Other substances may cause brain damage, harm to the nervous system, asthma, and skin problems. The harm done by dangerous substances can occur from a single short exposure or by the long-term accumulation of substances in the body. Dangerous substances contribute significantly to the 350 million working days lost through occupational ill health and to the suffering of over 7 million people who are victims of occupational illness[2]. The considerable costs to business from the ill health and disability to workers include sickness absence costs and lost productivity.

However there are more reasons for tackling risks from dangerous substances. Across Member States a common set of European directives aimed at preventing health and safety risks in the workplace apply. Through these directives, employers are responsible for ensuring that employees are not harmed by work, including through exposure to dangerous substances.

Annex 1 provides details of other Agency publications where further information can be found on dangerous substances, including biological agents.

Sharing good practice

An important role of the Agency is to make information available to support and promote the prevention of risks from dangerous substances. This includes stimulating the sharing of information to solve common problems.

This publication and the Agency's website aim to show that risks from dangerous substances can be solved in many ways. They provide real examples of how companies and organisations have made interventions and sought to reduce exposure to dangerous substances.

Each workplace is different. Therefore work practices and solutions to problems must be matched to the particular situation by carrying out an assessment of the risks at the actual workplace concerned (see Box 1). Nevertheless risks from dangerous substances are rarely unique and solutions can be transferred across various sectors and sizes of enterprises, and Member States.

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[1] Paoli P. and Merllie D. (2001), Third European survey on working conditions 2000, European Foundation for the Improvement of Living and Working Conditions.

[2] Source: Eurostat, the Statistical Office of the European Communities. The statistics are for the 1998/99 financial year and are quoted by the University of Huddersfield at http://www.hud.ac.uk/has/news/natarchive.htm#eurostat

Box 1
Risk assessment

Before good practice information is applied, an assessment of the risks present in the workplace should be carried out and reference made to relevant national legislation. A risk assessment is a careful examination of what could cause harm to people, so that you can decide whether you have taken enough precautions or need to do more to prevent harm. The aim is to make sure that no one gets hurt or becomes ill. If a risk assessment is not carried out before implementing good practice information, there is a danger not only that risks may not be controlled but also that there may be a waste of resources.

For dangerous substances a useful approach to risk assessment is:

1. **Make an inventory** of the substances used in the processes in the workplace and those generated by the processes such as welding fumes or wood dust.
2. **Collect information** about these substances, i.e. the harm they can do and how this can happen. Safety data sheets (SDS), which must be provided by the supplier of a chemical, are an important source of information.
3. **Assess exposure** to the identified dangerous substances, looking at the type, intensity, length, frequency and occurrence of exposure to workers, including combined effects of dangerous substances used together and the related risk.
4. **Rank the severity** of the established risks. This list can then be used to draw up an action plan to protect workers.

The practical examples

The 29 examples of good practice on the prevention of dangerous substances presented here are all award winners or commended entries in a European competition, run as part of the European Week for Safety and Health at Work 2003. The aim of this Agency initiative is to support the dissemination of good practice information about risks from dangerous substances and promote the application of 'practical solutions' in workplaces in Member States and across Europe.

The examples come from 14 EU Member States and include small and medium-sized enterprises, large companies and intermediary organisations operating in very different sectors. Some examples aim to tackle risks at source through technical solutions to prevent exposure or implementing organisational measures. Others aim to substitute a hazardous substance for a less hazardous substance. Box 2 illustrates the different levels of intervention. Box 3 provides some advice on substitution. Each example describes the nature of the problem, the solution applied and the results. There are some comments about the key features of each example and areas where the good practice could be further developed.

Box 2
Levels of intervention

European legislation provides a hierarchy of measures to prevent or reduce the exposure of workers to dangerous substances.

Elimination — the best way to reduce the risks connected with dangerous substances is to remove the need to use those substances by changing the process or product in which the substance is used.

Substitution — if elimination is not possible, then the substitution, or replacement, of the hazardous substance or the process with a less dangerous one under its condition of use is the next best option.

Control — if a substance or process cannot be eliminated or substituted, then exposure may be prevented or reduced by:

- enclosure of the emitting process;
- control of the emission by better management of the processes;
- technical solutions to minimise the concentration in the exposure zone;
- organisational measures such as minimising the number of exposed workers and the duration and intensiveness of the exposure;
- use of personal protective equipment.

The cases should inspire owners, managers and workers about what could be achieved in their workplaces. They are not intended to be definitive or to provide detailed technical guidance. Not all elements of all cases were successful and these short summaries present the best features to demonstrate what can work in practice and how to achieve it. Some enterprises developed their own solutions using in-house expertise. Others found it useful and cost effective to use consultants with expert knowledge and practical experience in preventing exposure to dangerous substances. The majority included the involvement of employees and their representatives to identify problems and develop solutions; this is crucial to success, as workers have firsthand experience of the work situation.

Box 3
Elimination and substitution in practice

Changing from one substance to another is a three-stage process:

Identify the alternatives: find out all the options available to you. Look for alternative process methods (to remove the need to use a substance entirely) and potential replacement substances (if elimination is not possible). If the substance you wish to replace is used in a widely applied process such as spray-painting or degreasing, then the number of options available is likely to be larger.

Compare the alternatives: carry out a risk assessment of all the alternatives, including the substance or process used, and compare your findings. Check relevant national legislation on occupational safety and health, as well as environmental and product safety legislation to ensure that the options are legal and compatible, and ascertain the minimum standards that you have to achieve.

Make the decision: take the decision based on the regulatory needs, technological possibilities, potential implications for the quality of the products, costs, including the required investment, and training for use of the new product.

Some hints on where to look:

Regarding **hazards caused by the process**:

- open processes, e.g. painting big surfaces, mixing/compounding in open containers/vessels;
- processes generating dusts, vapours or fumes or dispersing liquids in the air e.g. welding, spraying paint.

Related to the substance:

If you cannot change the work process, try to eliminate or avoid the exposure for substances that:

- increase fire and explosion risks;
- leads to high exposure of workers;
- results in exposure to many workers;
- are volatile, e.g. organic solvents;
- are dispersed in the air (aerosols, dust);
- cause acute health risks, e.g. poisons, corrosives and irritants;
- cause chronic health risks, such as allergens, substances toxic for reproduction and others;
- are covered by specific national regulations imposing restrictions of use in the workplace;
- have already caused problems in your enterprise (health problems, accidents or other incidents);
- cause occupational diseases;

A table in Annex 2 lists the country of origin of the example, its title, whether it won an award (if not, it received a commendation from the judging panel), the issue targeted, the relevant sector and an assessment of the level of intervention.

What the judges were looking for:

In selecting the examples the judging panel for the Agency competition looked for solutions that showed:

- tackling risks at source;
- real improvements;
- sustainability over time;
- good consultation between management and the workforce;

- compliance with relevant legal requirements, preferably going beyond minimum requirements; and
- possibility of transfer to other workplaces, preferably including those in other Member States and to SMEs.

Acknowledgements

The Agency would like to thank its network of Focal Points in Member States (competent authorities, or bodies nominated by them, responsible for occupational health and safety) for assessing and nominating good practice examples for the Agency award scheme. The competition would not have been possible without their assistance. The Agency also thanks the experts who made up the judging panel for their input. Last but not least, many thanks to the organisations who are featured in this publication for their initiative!

European Agency for Safety and Health at Work

November 2003

2.

PRACTICAL SOLUTIONS

2.1 DUST CAPTURE IN METAL GRINDING

VAE Eisenbahnsysteme GmbH

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Austria

www.vae.co.at

Issue

Measures for reducing dust from grinding and smoke from welding during the production of iron and steel components.

Problem

Intensive grinding work is required during the production and assembly of turnout components especially frogs, tongue rails, ribbed plates, insulated joints and small parts. Hazards including atmospheric emissions of grinding dust and welding smoke, are typical of metalworking.

The company was using an extractor system in the form of 'extractor walls' for the grinding of frogs in workplaces in the production halls. This system was a major help in reducing dust levels, but could only remove the dust on one side. Although exposures were below legal exposure limits, the dust was still dispersed in all directions through the halls, affecting not only the employees involved in grinding (around 30), but also all the other workers (around 150) in the shed. The dust also constituted a diffuse emission source. There were also no extractor systems available for the grinding of tongue rails. Extractor walls were used in combination with a filter for the grinding of ribbed plates, but again these walls were unable to draw out all the dust.

Solution

The company decided to make further improvements to dust and pollutant control, and set up a special project, which had the following aims:

1. The prevention or reduction of dust/smoke emissions wherever possible, e.g. through design measures (bolting, precision working), technical solutions (cutting instead of grinding, etc.) or the appropriate choice of materials (suitable grinding disks).

2. Maximise the capture of the dust particles (optimum capture concepts) as welding smoke and grinding dust cannot be entirely excluded from the metalworking process
3. Subsequently, the removal of particles as efficiently as possible (efficient filter systems for air extraction and circulation).

In addition, they wanted improvements in noise levels and lighting conditions.

Appropriate finance and staff resources were made available and the project team included the affected employees, managers, occupational physicians, works council representatives and prevention specialists.

They looked into possible solutions, holding discussions with potential suppliers and talks with the health and safety authorities. Around a dozen design ideas were prepared and assessed. The final solution for frog and tongue rail grinding, specially designed grinding cabins with a 'tunnel' extractor system, contained details from these suggestions. A prototype cabin was built and tested for frog and tongue rail grinding. Other improvements were made in the extraction and filter systems for insulated rail joint grinding, tool grinding and ribbed plate tacking.

The changes introduced included:

- 8 frog grinding cabins with extractor system;
- 3 tongue rail grinding cabins with extractor system;
- 1 spot extractor for ribbed plate grinding;
- 1 spot extractor for insulated rail joint grinding;
- 1 cartridge filter on the flame cutting machine;
- 2 cartridge filters for ribbed plate tacking;
- the redesign of the tool grinding shop to optimise dust capture.

With the ribbed plate grinding and insulated rail joint grinding, the solution was based on spot extraction located as close as possible to the dust source.

The grinding cabins were introduced for frogs and tongue rails where spot extraction directly at the grinding machine, or in the immediate working area was not possible. They consisted of metal, soundproofed perforated sheets. The extractors at the rear of the cabin can extract dust across the entire cabinet. The extracted air is cleaned in cartridge filter units, which also extract nickel and chrome

Before: grinding of frogs

After: frog grinding cabins

After: spot extraction for insulated rail joint grinding components. The new cabins also incorporate improvements for handling work pieces and lighting.

A cartridge filter from an old grinding wall was converted and integrated into a flame cutting machine, in order to cut emissions, including to a storage area adjacent to the cutting machine.

In the ribbed plate tacking area, new mobile cartridge filter units were fitted. They had improved filtering levels and incorporated automatic cleaning, and replaced old, maintenance-intensive filters.

In the tool grinding shop, each line system was fitted with a rotary plunger, whereby extraction only occurs at the unit in operation and so that this is provided with maximum suction and capture speed at the grinding disk. Suction lines were carefully placed to prevent stumbles.

The company worked with outside experts to obtain the technical measurements necessary to verify the results. Cooperation with experts from the public authorities (labour inspectorate including medical, mechanical engineering and emission specialists) formed an important part of the project.

Results

- A reduction of 80–90% in atmospheric dust loads with the help of the new frog and tongue rail grinding cabins (and hence a reduction in the impact on all workplaces in halls 3, 4 and 5).
- 25–50% dust reduction in the frog and tongue rail grinding cabins.
- 60% dust reduction on the grinding machine operators and the hall atmosphere due to spot extraction during ribbed plate grinding
- 25% dust reduction for the store workers in the “steel construction area” through the installation of a filter in the autogenous cutting extraction system.

Additional improvements included: improved lighting to reduce glare and shadows; draught reduction; and noise reduction by 10 dB(A) for the machine operators and the surrounding hall area following the introduction of the cabins.

The total investment was around EUR 400,000. Apart from improved worker health and safety, the benefits of less airborne dust include:

- Less cleaning (windows, machines, walls, etc.)
- Less impact on the employees due to cleaning agents (hydrocarbons, etc.)
- Lower maintenance costs
- Calculated total savings of around EUR 70,000 p.a.

Comments

Team working both in the company with the participation of employees and with external authorities was important in this example. The management of health and safety is integrated into the management system of the company. Specific safety and health protection programmes are set, in which projects, budgets, dates/priorities and responsibilities are defined on an annual basis.

2.2 LOCKOUT – MEASURES FOR MAINTENANCE

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Issue

Mining and production of mineral materials. Protecting maintenance staff during maintenance of equipment, units, vehicles etc. Lockout measures to prevent unintentional restarting of units or escape of hazardous substances during maintenance and repair works; improved communication between maintenance – production.

Problem

Maintenance and repair works cover over 500 tasks – from changing electric bulbs to repair works on milling or crushing units. A comprehensive assessment of all hazards from dangerous substance to maintenance mechanics and electricians included: diesel oils, hydraulic oils, petrol, hydrochloric acid, cationisation agents, pressurised gases and liquids, cleaning agents, bottled gases (acetylene, nitrogen, oxygen, protective gas), liquid gases, welding gases, solvents including ethanol, boiler and drying unit flue gases, and exhaust air. Many of the substances were highly combustible, under pressure or at high temperature.

There was concern that it was possible to switch on units unintentionally while maintenance was taking place, as the only protection was through warning signs. Therefore, the company decided to introduce a lockout system.

Solution

Following risk assessment, a lockout system was established to prevent employees switching on units under maintenance or repair works unintentionally and thereby

Lockout on a pipe to prevent unintentional release of hot stem. The master lock in the red box blocks the clip. The master lock cannot be removed before the two workers have removed their personal keys

avoiding emission of hazardous forces or substances. Technical changes to units involved fitting stopcocks and lockout tools etc.

A procedure covering all units and tasks was established detailing how the risk sources in all maintenance tasks should be made safe before work starts (lockout procedures). These procedures were integrated into the company's safety management system.

Among the issues covered by the lockout procedures are: decontamination, derivation of stored energies, safeguarding of larger ventilation fan bogie wheels, safeguarding of vehicles, lock-up, block-up or finishing of movement of units, cables, pipes or containers. The links to control and procedure systems are shown. The anchor points for safe guarding and inspections are included. The system works through the use of a master lock out key together with personal lock out keys in the exclusive possession of the maintenance workers.

Master lockout

- Before maintenance work is begun a lockout manager (LOM) is appointed. This person ensures that the system, plant or equipment is made safe in accordance with the lockout procedure. The lockout manager (LOM) is responsible for making safe and locking out the relevant unit for maintenance. Lockout managers must be trained, tested and certified as competent to carry out the isolation procedure for the particular maintenance task.

- The lockout manager applies the master lock and records their name in the lockout list. It has to be ensured that the master lock will remain on the equipment even when all other locks have been removed. Only the lockout manager holds keys to the master lock.
- After locking all the necessary locks, the lockout manager (LOM) clears the area of personnel before a trial step is carried out to ensure that the plant or equipment has been isolated (e.g. turning on or trial of setting in motion). Then the maintenance work can begin (see below).
- If the work covers more than one shift, the key for the master lock is handed over to the new shift's lockout manager, whose name is recorded.
- After completion of the work and removal of all locks (the master lock is the last to be removed), the lockout manager carries out a trial step to ensure the proper function of the unit, records the completion of work in the lock out list and informs the production department.

Personal lockout

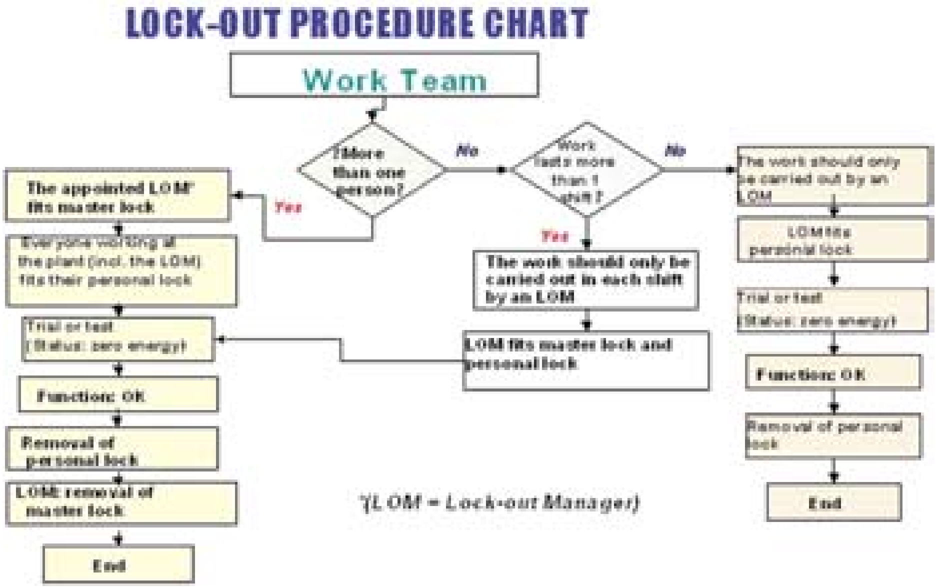
- Following set-up of the lockout procedure by the lockout manager, but before maintenance work starts, the employee carrying out the work must apply their personal lock and identification tag. This procedure also applies to all contractors, which have to get their personal locks from their contact person in the company. Each employee holds the key to his or her personal lock. No additional keys are kept.

- Following completion of the task, only the owner of the key can remove their lock (that is, the person who has carried out the task). If a personal lock is left behind and the relevant employee cannot be found (for example if the worker has gone home at the end of the shift), the lock can be removed (by cutting it up), but only after the situation has been analysed and agreed by the plant manager.

All employees are trained about the lockout system. To support this, leaflets, flow-chart explanations and other information and training resources were developed.

Results

The potential for accidents during maintenance has been reduced. Application of the lockout system prior to starting a maintenance task also helps to remind employees of the hazards present. Following its introduction, communication and planning of maintenance between the production and maintenance teams has improved. Although significant costs were involved to implement the new system, there has been a significant reduction both in lost time and the severity of injuries.



Comments

Maintenance hazards often get over looked. Cooperation and coordination is very important. It is equally important to include contractors in safe maintenance systems. Here prevention of risks from dangerous substances is part of a wider occupational safety and health approach to risk prevention.

2.3 SAFETY FOR CHEMISTRY STUDENTS

Katholieke Universiteit Leuven

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Belgium

www.chem.kuleuven.ac.be/safety/index.html
www.kuleuven.ac.be/admin/lp/niv2/pd-k01.htm

Issue

Drawing up of a risk analysis for university chemistry students

Problem

Chemistry students have to attend practical seesions. When carrying out experiments, these students can be confronted with a wide range of risks. An important risk is exposure to chemical agents and two issues arise:

- The students are insufficiently aware of the dangers and risks linked to the use of dangerous products and equipment.
- The students will require safety awareness and knowledge in their future professional careers.

Solution

A methodology was developed for carrying out prior risk assessments of student laboratory work. The development and implementation involved several stages.

1. The local, external prevention service developed a concept for carrying out risk assessments. This was done in conjunction with the environmental service, the occupational health service, the students and employees working in the laboratories.
2. A working-group 'Safety and Didactics' was set up.
3. The working-group formulated basic rules for practical chemical work, which included the principle of making a prior risk assessment. Before starting their experiment, the students have to make a risk analysis.
4. A training course was organised for staff attending practical work.

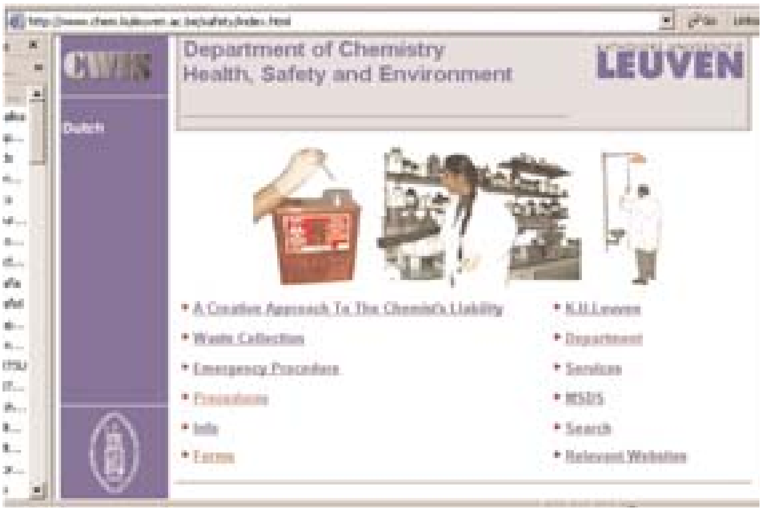
5. Basic rules for practical chemical work were proposed to the committee for prevention and protection at work.
6. The basic rules were distributed as working instructions using various methods. They were also included in the manual for the practical work, which is given to all students.

Concept for the risk analysis of experiments with dangerous substances

Once the concept was developed, it was converted into in a practical form. The form can be used both in research laboratories and chemical practices. The form follows the hierarchy for prevention measures. The form is used to record:

- the experiment and the chemicals and equipment used;
- the staff and students exposed;
- the risks associated with the products and the equipment used;
- means of removing hazards at source. The replacement of very dangerous products by less dangerous ones has to be considered first. If this is not possible, the use of the substance should be minimised by reducing the quantity used as much as possible;
- the necessary prevention and control measures. Exposure has to be limited by using collective and, if this is not sufficient, individual protection equipment
- supervision of students;
- disposal of waste;
- the precautions to take in case of accidents, emergency and first aid.

For certain hazardous chemicals, there has to be a proven case that their use is essential and that they cannot be substituted. The safety department has to approve the use. They also coordinate requests for use of chemicals that require a special license.



'Safety and Didactics' Committee

A working committee was created. In addition to the prevention service, the occupational health service and the environmental service, members of the different relevant faculties where dangerous products are used were represented. These representatives were mostly people supervising practices.

The basic rules

The committee formulated basic rules, which included the concept of making a prior risk assessment. The rules were then proposed to the prevention and protection at work committee. Following agreement, the basic rules were distributed as working instructions in different ways:

- Publication on the website.
- Discussing them during the training of the practice supervisors. Training for starting supervisors in safety, occupational health and environment is organised annually by the prevention service.
- Inclusion in the manual for chemical practices.
- Inclusion in the student's information pack. This pack deals with safety, health and environment in laboratory and chemical practices. The pack is handed out to first year students in chemistry in the form of a CD-ROM. Other students can consult the information on the Internet.

Results

The students have an improved awareness of risks and precautions. The prevention hierarchy is better obeyed. In a number of experiments very dangerous products have been replaced by less dangerous alternatives. More attention is paid to the use of fumehoods and the use of personal protective equipment such as lab coats, spectacles and gloves.

Comments

Inclusion of students in risk prevention not only improves risk prevention in the academic institution, it also provides students with a basic grounding in safety that they can take with them into their working life.

2.4 CHEMICAL RISK PREVENTION IN SCHOOL LABORATORIES

Ministry of the French-speaking Community

Directorate of SIPPT
Bld Léopold II 44
B-1080 Brussels
Belgium

www.espace.cfwb.be/sippt
(click on the heading 'dangerous substances')

Issue

Development of various communication tools for school chemistry laboratories, in order to increase safety and awareness of risks related to the use of dangerous substances.

Problem

A research study and a separate investigation by the Federation of Chemical Companies (Fedichem) in more than 200 school laboratories had indicated that safety measures applied in school chemistry laboratories were insufficient. It pointed out a lack of knowledge and information concerning the level of chemical risks present in the laboratories. The studies recommended the development of a programme of communication tools.

The Ministry of the French-speaking Community wanted to improve the safety culture and risk prevention in school chemistry laboratories. It wanted teachers to be in a position to implement safety measures in the school laboratories. They wanted laboratory personnel to be knowledgeable about and be able to

School laboratory with an air extraction device

implement safety procedures, to be aware of the implications and risks associated with specific experiments, and to be able to intervene effectively in cases of fire or other accidents.

Solution

As recommended by the studies, the Ministry is involved in the ongoing development of various, adaptable communication tools to achieve the objectives described above. The Ministerial Office, the inspectors of chemistry and the industrial doctor colaborated together in the development and implementation of their tools. The resources developed include:

- A **booklet,** *Common sense in the use of dangerous products* providing easily accessible information about legal requirements, chemical labelling, maintaining an inventory, and managing dangerous products (storage and handling, protection equipment, elimination of waste, safety rules, good practices, etc.).
- A practical **control checklist** made up of a series of questions which makes it possible to measure whether the laboratory conforms with the regulations and methods of best practice. Practical explanations and legal references accompany all the questions. The questions are organised by topic e.g. chemicals, storage of chemicals, fire precautions, etc.
- **Training and information** sessions for teachers and assistants on chemical risks in school laboratories and their prevention, and the use of communication tools, including software tools. These training sessions are organised in collaboration with the service responsible for designing and enforcing guidelines for chemistry courses (Inspectors for Chemistry).

- **A list of prohibited substances** covering young people at work, pregnant workers, carcinogens and other chemical agents.
- A list of **frequently asked questions.**
- **Software for printing safety labels** for the chemicals used in school laboratories
- **School laboratory guidelines** covering pupils, their behaviour, safe use of equipment, hygiene and health and handling of chemicals.
- **Special lessons** to introduce the concepts of safety and prevention measures to both teachers and pupils.
- **An information circular** sent to all secondary schools covering: chemical risk prevention principles; the communication tools and their objectives; and the roles and responsibilities (civil and penal) of the management, teachers, and assistants as well as the responsibilities of the adviser in prevention and legal matters.

Results

The tools have been positively received. Schools are now in a much better position to understand the risks involved, to carry out their own risk assessments and bring in the necessary measures and infrastructure for the safe handling of dangerous chemical materials. Follow-up actions are planned, such as the storage of the dangerous substances, the elimination of waste products, and implementation of a uniform infrastructure throughout all school laboratories as well as the placement of resources on the website.

Security locker for flammable products stored inside the laboratory

Comments

Workers and others on site, such as pupils, should be included in risk prevention. School safety requirements can be used as a means of educating pupils in general about safety and health principles.

2.5 ENVIRONMENTAL ASSESSMENT AND CHEMICALS MANAGEMENT

Decra A/S

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BST job+miljø A/S
Allé 26
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Denmark
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Issue

Production of galvanised steel and stone roofing. The company worked with an external organisation to bring in a lasting, chemical mamagement system.

Problem

The production process of galvanised steel and stone roofing requires the use of a large number of chemicals. The company had no formal policy to manage the health and safety aspects of the chemicals. There was concern that the health of employees was being put at risk and uncertainity about whether the right means of protection were adopted and used correctly. They had been trying to solve some chemical management problems without lasting success and realised that they needed external support. Initially they contacted BST job+miljø (an occupational health service) to obtain help in drawing up workplace chemical handling safety instructions, but it was agreed that although this approach would involve quite a lot of effort to achieve, it would not be a sufficient solution to properly manage the chemicals.

Solution

Having agreed that a comprensive chemical risk management system needed to be put in place the first step was to carry out a survey of the existing situation. The survey revealed that workplace instructions were not kept up-to-date and often were not being used, that employees' knowledge of the risks was inadequate and that chemical safety regulations were not being adequately complied with. The survey was also used to record which products were actually being used and how, in order to propose improvements in procedures and to see if substitution with safer substances was possible.

Subsequent stages of evaluation and implementation of control measures included:

Clearing/removal of chemicals

An examination of the products revealed that many could be disposed of and the number of different products used was reduced from 106 to 66.

Mapping of products

All products including constituents were registered in a Pivot-table (a special Excel database), with information about product name, constituents, labelling etc.

Evaluation of products

All products and constituents were checked against the relevant lists relating to the legislation on exterior and working environment. This made it easy to compare products, for example, in order to phase out carcinogenic or caustic products first.

Flow chart of product evaluation

Preparation of chemicals safety policy

The company introduced a chemicals policy requiring that hazardous products be phased out and replaced them with less hazardous products. Previously many different employees purchased new products. Now only named employees carry out this task, in accordance with the policy. Before a department is allowed to put a new product to use, the product must be approved by the quality and environment coordinator.

Incorporation of the company's quality control system (ISO 9001:2000) into their genereral instructions, with the support of the occupational health service.

Workplace evaluation of working processes

With support form the occupation health service, the company's working processes were mapped and a workplace evaluation was carried out in consultation with employees.

Use of noticeboards to provide general instruction to the workforce

With the help of the occupational health service, a series of noticeboards were prepared and located at the actual place of work. Pictogrammes were used to help provide the informtion in a simple and visible way. The employees were involved in the preparation of the noticeboards. A rough outline of the proposal was shown to employees who have subsequently had discussions in small groups. The noticeboards included:

- a noticeboard depicting the local conditions at the place of work with which the employees must be acquainted. The noticeboard information was made consistant with wording used in the company quality control system;
- a noticeboard depicting the location of the company's escape routes, evacuation point, fire fighting equipment etc. Additional information such the location of eye washes, means of protection, alarm telephones etc., was also provided. The locations were marked on the noticeboard by pictogrammes, enlarged copies of which were placed on the physical locations;
- adapting a noticeboard depicting emergency measures to incorpoorate additional health and safety measurements, with help from occupational health service;
- following the workplace evaluation, noticeboards depicting means of protection. Each noticeboard related to particular work processes.

Planning for regular monitoring and review

Follow-up and review activities have been planned. A plan to examine and improve conditions related to personal hygiene has also been initiated.

Results

Apart from improved worker health and awareness and compliance with legislation, the new system has enabled some efficiency benefits to be introduced, such as the use of fewer chemicals and obtaining purchase discounts by placing orders for greater quantities of the remaining chemicals used with fewer suppliers. The pictogrammes have proved to be a more accessible method of informing and instructing workers, including those who do not have a high reading level. The safety management system is also more efficient to administer than the old *ad hoc* methods.

The system has subsequently been adapted and introduced into several other companies.

Comments

Managing health and safety contributes to the efficient running of companies. Submitting the purchase of dangerous chemicals to a notification and approval procedure within the enterprise combined with an active substitution policy helps reduce the amount and number of hazardous substances used. However this process has to be kept dynamic and the use of substances reviewed regularly to ensure that the system is adjusted to new findings and regulations.

2.6 METAL DEGREASING – FROM SOLVENTS TO DEMINERALISED WATER

Grundfos A/S

Poul Due Jensens vej 7
DK- 8850 Bjerringbro
Denmark

Tel. (45-87) 50 14 00

Issue

Finding a safer method of degreasing metal components prior to subsequent manufacturing process.

Problem

Metal components have to be degreased before further machining such as punching, welding, finishing, mounting etc. Failure to degrease can also increase exposure to hazardous substances for workers on the subsequent processes, such as welding. Large quantities of solvents, including chlorinated solvents, were used in the degreasing processes.

The risk of exposure to organic solvents during the degreasing arose mainly from:

- manual handling of subjects boxes where the solvent on the component had not completely evaporated;
- insufficient process ventilation;
- direct contact with the skin;
- cleaning and maintenance of equipment.

Solvents can cause irritation of eyes, skin and airways. At repeated and prolonged exposure the central nerve system can be affected both in the short and long term. Short-term symptoms include headache, dizziness, nausea and unconsciousness. Long-term effects can be fatigue, loss of appetite, memory difficulty, irritability and weakened learning capacity. Some solvents also have other long-term effects such as cancer, reproduction damages or allergy.

To meet the present emission limits value both mass flow calculations and specific control measurements were made by external companies.

The company therefore wanted to replace the solvent products with something less hazardous.

Workers in the central washer

Solution

The company already had in place an ongoing substitution approach. Some years before the company had implemented a project to eliminate the use of organic solvents for degreasing of metal components.

The project covered:

- determining the necessary level of purity for the further machining;
- contacting suppliers about alternative products;
- testing of products both in the laboratory and in the production;
- risk evaluation of alternative products;
- evaluation of different technologies for use at degreasing;
- implementing in the production.

As a result the company changed to using alkaline degreasers with the following results:

- Installation of two large central washers with a strong alkaline degreaser for the most demanding degreasing tasks. The equipment is filled automatically. No employee is in direct contact with the product.
- Installation of smaller closed washers in connection with sub processes with alkaline products.
- No use of organic solvents

Continuing its substitution policy, the company then wanted to move to replace the use of the solvents completely in the degreasing process. They had set targets to reduce the number and the consumption of chemicals.

The company decided to examine the following options:

- abolishing the degreasing processes in full or in part;
- replacing the solvent materials with something less dangerous;
- examining the possibility of technical solutions to limit the exposure risk.

They set up an environmental learning group. The group carried out degreasing with demineralised water and process temperatures were lowered from 60°C to 40°C.

The company was able to implement various improvements:

- More environmentally sound products used in the two central washers and controlling the use of the products in the right concentration. There is

automatical filling and the process is completely enclosed, eliminating worker exposure and reducing manual handling
- Several smaller washers that use a low alkaline degreaser or demineralised water, with 50% using demineralised water.
- Limited use of low alkaline degreaser.
- The degreasing process takes place at low temperatures and therefore reduces the energy consumption.
- Oil shimmers mounted on washers. The water can be recycled over a longer time period and reduces water consumption.

Results

In addition to improving worker and environmental safety, chemical use has been reduced by nearly 60%, which has resulted in considerable cost savings.

Comments

The changes and policy formed part of the company's quality standard certification measures. The substitution process took place over a number of years, where initially a very hazardous substance was used, followed by a move to a safer substance, followed by further efforts to replace this safer substance too. Worker participation was important for the success of this solution.

2.7 CHEMICAL SAFETY ON MERCHANT SEA VESSELS

Danish Maritime Occupational Health Service

Amaliegade 33B,
DK-1256 Copenhagen K
Denmark

E-mail: info@seahealth.dk
www.seahealth.dk

Issue

Raising awareness and implementing a chemicals control policy among merchant ship owners and on board vessels.

Problem

Both a ship's cargo and chemical products involved in day-to-day operations on board ships can create serious hazards for maritime workers. The many dangerous substances that can be encountered include asbestos, benzene, two-component paints, solvents and various oil products. There was often lack of safety knowledge and poor control of chemicals.

Solution

The action was achieved through the Danish Maritime Occupational Health Service promoting action and providing advice and assistance, and facilitating cooperation between manufacturers, ship owners and those responsible on board vessels.

An important part of the action included establishing a safety database of products commonly used on Danish vessels – the Marine Chemicals Database.

Phase 1: registration and sorting out which chemicals were actually carried on board and used.

Phase 2: formulating a chemicals policy among ship owners and on board vessels.

Phase 3: assessing the hazards, including by obtaining product data, as the basis for selecting less harmful products and substitution.

Once the database was established, the results were used to produce an interactive CD-ROM[3], which includes safety data sheets that could be used to assist risk assessment, and draw up prevention measures and safety instructions and for users to register the chemicals that they are using. Products are screened and preferred products are indicated on the database. This is helpful to those purchasing products when the ship is abroad, where they do not have access to national information regarding the products safety. Information is also available via the web.

The CD gives the user the opportunity to select between Danish and English, to print out the instructions as required and to set up and maintain the ship's stocks of substances and risk assessments. Furthermore, various search systems have been included on the CD and these make it easier for users to find their way around the system. The CD was been developed in close collaboration with users and has a built-in users manual.

The Maritime Occupational Health Service also provides assistance to ship owners to clear out unwanted chemicals and streamline the number of chemicals they use.

Regular meetings are organised with participating ship owners and the major product suppliers/producers to discuss safety improvements and strategy for the database. The database has also prompted closer working with product manufacturers and suppliers, who provide updates on their listed products.

The Danish Maritime Occupational Health Service publishes material to support implementation of legislation as well as resources on surveys relevant to the

[3] Working environment at Sea 3.0 – electronic edition, PC PROGRAMME published November 2002.

environment and to other aspects of working life on board (see http://www.seahealth.dk/english/54/71.html for more information)

Results

- Improved control of chemical cargos and products used on board.
- Improved knowledge and awareness of crew of merchant vessels as regards risk assessments and safe working procedures.
- Financial savings from cutting down on the numbers of chemicals used

Comments

Solutions need to be tailored to the circumstances. Obtaining substance data information when abroad is an important issue in this sector. Providing such information has been integrated into a solution to improve knowledge and risk management to meet the needs of the sector.

2.8 24-HOUR SAFETY - A COOPERATIVE APPROACH BETWEEN SOCIAL PARTNERS

Chemical Industry Federation of Finland

Kemianteollisuus ry, PL 4
FIN-00131 Helsinki
Finland

www.chemind.fi/safety

Chemical Workers' Union

Kemianliitto - Kemifacket ry, PL 324,
FIN-00531 Helsinki
Finland

www.kemianliitto.fi

The following organisations also participated: Finnish Association of Consumables and Speciality Products Manufacturers, KET/Finnish Association of Glass and Ceramics Manufacturers, Association of Finnish Shoe and Leather Industries, Rubber Manufacturers' Association of Finland, Finnish Association of Launderers and Dry Cleaners.

Issue

A cooperation network to improve safety in the chemical industry

Problem

Finland has two main approaches to achieving safety and health improvements: the zero accident approach connected to the prevention of accidents, and an approach that highlights workers' well being at work. Although progress to improve health and safety had been made, it was felt that more innovative ways of supporting these approaches were needed in order to make further progress in reducing the comparably low number of work-related accidents. One way forward is to put in place effective cooperation between intermediary organisations in order to reach enterprises effectively.

Solution

The Chemical Industry Federation and the Chemical Workers Union held a meeting to discuss implementing a project in the sector to improve health and safety through cooperation. The participants were aware that cooperation forums for occupational safety, which involved other parties in addition to the participants, already existed. However, they decided they wanted more direct and concrete cooperation. In addition, the participants wanted the project to promote safety in actions and attitudes throughout the day, in all activities, both at work and during time off, i.e. 24 hour safety.

They established a working group, consisting of representatives from the participating organisations, to explore the idea of the Safety 24h project, to promote innovation within enterprises to improve safety by seeking new ideas and procedures.

Safety 24h is a joint project within the chemical industry and other closely related industries. Its purpose is to find solutions for safety issues at the workplace. The objective is to create new ways of thinking, find practical tools, benefit from experience and exchange of information and knowledge.

Safety 24h is based on development projects carried out within enterprises. These are structured using a flexible operating model, as well as a common schedule and reporting practices. The programme also includes interaction between project groups, and support materials intended for common use.

The organisations behind the Safety 24h project offered all participating enterprises a common, but fairly flexible, operating model, with the intention of creating a team sport aimed at improving safety. Organisations that are parties to the collective labour contract of the Chemical Workers' Union were also invited to take part.

Four areas of development were specified:

- management and measuring procedures
- attitudes
- reporting and research
- risk assessment.

However, the projects were essentially based on the individual needs of each enterprise.

The objective was to create an effective network of cooperation within which experiences and know-how would be shared as the project went on. The enterprises and project groups promised to report on the progress of their project, as well as on any results that were achieved. The project groups were offered support in the form of communication, and were encouraged to tackle challenges through interaction.

The overall programme was based on individual development projects carried out within enterprises. Each enterprise or project group chose their own focus according to their individual requirements. The Safety 24h project consisted of 41 projects that were carried out in 39 enterprises. The summaries of enterprise-specific reports have been collated in the Safety 24h final report. The extent of the projects varied from the removal of one defect to an extensive programme that involved the corporation-wide development of an occupational safety culture.

Results

The evaluation of risks involved in work tasks has greatly improved in many enterprises as a result of the Safety 24h project. In fact, many enterprises noted that the Safety 24 h project had sped up many ongoing activities or led to the initiation of necessary projects. Many of them involved the creation of practical safety management procedures for different sectors. Reporting of deviations from the normal level of safety, that is near-miss situations, and practices to do with this reporting were promoted through the projects. Participation in improving safety, involving workers and the whole organisation has also been encouraged. The projects have provided practical examples that others can follow.

Some enterprises have become interested in safety at multi-employer workplaces and the programme has helped others put in place safety requirements for contractors and subcontractors. The project resulted in new models of safe operations and took into use some common ways of operating at multi-employer workplaces.

Comments

Successful partnership projects require common commitment and effective cooperation, as achieved by this project.

2.9 TRAINING IN SAFE AND ENVIRONMENTALLY FRIENDLY USE OF CHEMICALS

Finnish Institute of Occupational Health

Uusimaa Regional Institute of Occupational Health, Arinatie 3A
FIN-00370 Helsinki
Finland

Tel: (358-9) 47 47 29 36

Issue

Introducing a risk assessment scheme and a training programme for chemical hazards at small-scale enterprises, covering both worker and environmental safety. Sectors included: printing; manufacture of fabricated metal products; construction; sale, maintenance and repair of motor vehicles; and washing and dry cleaning of textile and fur products.

Problem

The major risks in some small companies come from hazardous substances present at the workplace. Many different chemicals are used in metal surface treatment, textile cleaning, printing and car repair shops. The small enterprises in the targeted sectors often lack the knowledge and resources to deal with chemical risks, while increasingly the larger organisations that subcontract them are demanding that they meet high safety and environmental standards. Small enterprises also need simple, clear guidance for chemical risk assessment.

Solution

It was decided that a scheme to develop practical skills within small enterprises and provide them with support regarding chemical safety was needed.

The project included:

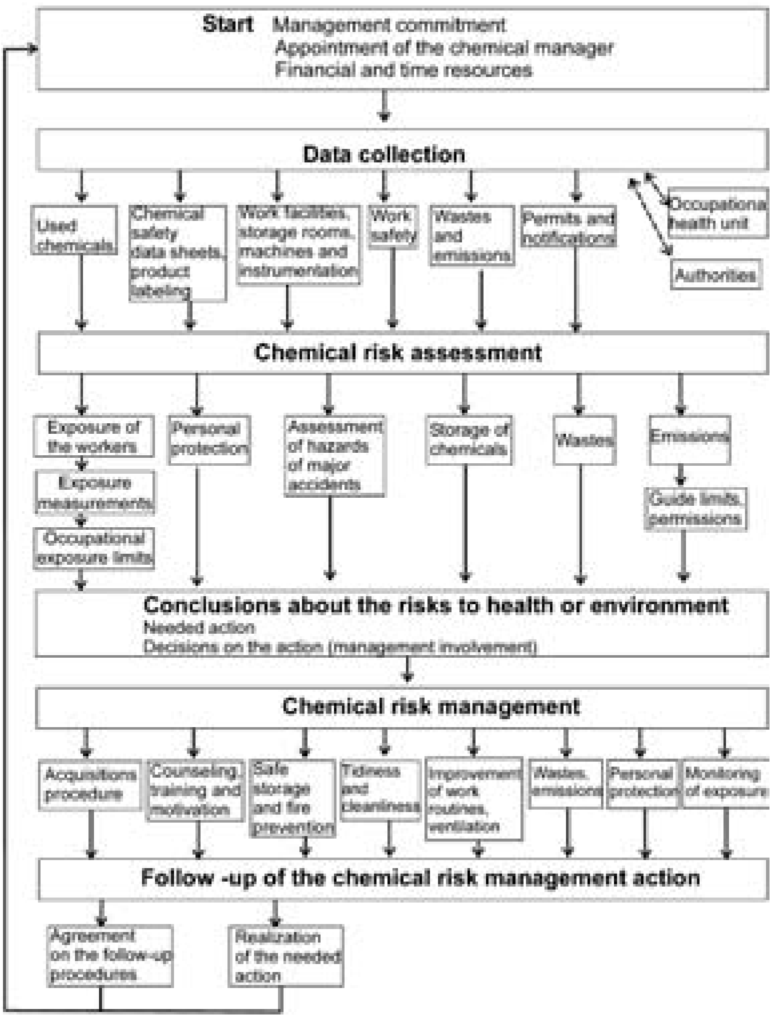
- assessing the situation and needs within enterprises
- training managers, foremen and workers of small firms to assess health, safety and environmental risks arising from the use of chemicals

- guidebooks on chemical risk assessment and management for five industrial sectors
- developing a chemical risk assessment support scheme with the assistance of own staff, specialists and authorities

Assessment of chemical risks in company level

Chemical and environmental data in each firm were collected with the help of questionnaires. Expert consultants carried out site visits at each company. The production methods and facilities, the chemicals used, the quality of safety data sheets, the accuracy of product labels, technical precautions taken to reduce

Chemical risk assessment scheme



occupational exposures, use of personal protection, waste treatment and pollution discharged into air and water were all assessed in cooperation with the chemical manager. Chemical managers started compiling their risk management strategy.

Many problems were found. All participating sectors had difficulties when using chemicals. There was considerable variation in awareness of and resources for assessing chemical hazards. In most firms some safety data sheets were not available or were out of date. Finnish translations of product labels were missing on many imported chemicals. Chemical legislation was considered confusing. Risks associated with allergenic or carcinogenic substances proved to be difficult to assess, although the hazards of widely used chemicals like solvents and acids were fairly well known. Nevertheless there was a genuine interest in learning more about the risks associated with chemicals.

Training of the workers and chemical managers

Chemical managers were trained at sector-oriented courses. A series of seminars was arranged for chemical managers in each of the five industrial sectors. In addition to covering the basics of chemical risk assessment, the seminars also dealt with the hazards specific to each branch (risks when handling motor fuel in the car repair trade, the risks caused by surface treatment chemicals in the manufacture of metal products, etc.).

The training provided to workers in individual companies was tailored to the wishes of the workers and their supervisors. Views on chemical training needs were collected by questionnaires distributed to workers in each company. The workers had an active interest in the hazards of the chemicals they used at work and in the information on product labels and safety data sheets. Also, training in the use of personal protective equipment, first aid and fire prevention was very popular in many companies.

Chemical guidebooks

Sector-specific chemical guidebooks were prepared as training resources. The material for the guidebooks originated from the professional knowledge of the project team and from the experience of the participating firms. The guidebooks contain a summary of chemical legislation, and a scheme for assessing chemical hazards. The most successful part of the guidebooks proved to be a large table covering specific work tasks in each branch, with the properties of the chemicals, possible hazards when carrying out the task, the needed safety procedures plus environmental issues. The guides also provide practical information such as contact details of specialists, authorities, suppliers of safety equipment and various consultation services.

Risk assessment support scheme

Various follow-up measures were initiated in the target companies, for example:

- acquiring or updating their safety data sheets;

- compiling lists of the chemicals used ;
- checking and improving product labels;
- looking into the option of switching to less hazardous chemicals;
- assessing individual exposures and measuring exposure levels;
- monitoring and reducing the volume of chemical waste;
- determining and reducing chemical emissions into air and water.

The safety manager, the management, the personnel and the occupational health team discussed the priority order of preventive measures (technical and health-based) to be taken. They agreed on the time schedule for the actions, on the responsible persons and on the follow up.

Results

The project involved over 90 small enterprises and 3000 workers, who have received practical training and support resulting in the initiation of improvements in their workplaces.

Comments

For small enterprises information and training alone is often not enough, even if tailored to the particular sector, and it needs to be coupled with active support. Especially when having to carry out risk assessments, these enterprises often need additional guidance, active support and advice on how to use the information, as provided in this case.

2.10 CHEMICAL PRODUCTS 'USE/SECTOR' MATRIX

Caisse Régionale d'Assurance Maladie Alsace-Moselle

14 rue Adolphe Seyboth, BP392
F-67010 Strasbourg cedex
France

Tel: (33-3) 88 14 33 00
Online database accessible at www.cram-alsace-moselle.fr

Issue

Since 1998, the prevention service of the CRAM Alsace-Moselle has been drawing up a list of the substances and preparations used by enterprises and by sector. The objective is to help enterprises manage this risk and provide a technical monitoring service for the use of chemical products so that an accurate usage chart of these products in the region can be established.

Problem

To manage chemical hazards it is essential to first identify the hazards – that is, find out what chemicals you have in your workplace and the associated hazards. One way that companies can be helped to do this is through access to a reliable database of commonly used products in their industrial sector and the associated safety information. In addition, it can be useful for prevention services to know what products are being used in the organisations that they cover, how they are used in practice, and to get an overall picture of usage, in order to improve support for risk prevention, for example by providing common advice and planning wider-ranging preventive actions, and thereby also being able to provide more effective support to more organisations.

A suitable database, relevant to the needs of local enterprises and the prevention service of CRAM Alsace-Moselle (Alsace-Moselle Regional Health Insurance Fund) did not exist, so the prevention service decided to create one.

Solution

The solution has been to produce a database that charts the use of chemical products by sector – the 'use of chemical products/sector' matrix. Work began in the Alsace-Moselle region in 2001 to make a list of dangerous chemical products used in enterprises with over 50 workers, with the help of their medical officer.

A survey to elicit the information from enterprises was developed, called 'System for evaluating the occupational risk of chemical products in industries and skilled-craft enterprises' (SEPPI). The enterprises were asked to send a table listing all products they were using labelled toxic, harmful and irritant, indicating quantities used and the number of workplaces concerned. By the beginning of 2003 information had been received from 363 enterprises covering a total of 86,299 workers.

The resultant database, with the confidential data supplied by the enterprises filtered out, can be accessed on the CRAM Alsace-Moselle website (www.cram-alsace-moselle.fr). The enterprises concerned are divided into nine main sectors. For each enterprise an indication is given of the number of workers included in the survey, together with the percentage in relation to the total number of workers in the sector. Partner enterprises have been divided into different activity sectors. Details of the substances used and the number of preparations can be found in each activity sector.

The substances recorded enable access to an identification file, which contains information on labelling, synonyms, molecular formula and CAS number. The database covers 1,205 substances. It is updated on a regular basis and made available on the website of the insurance fund.

Results

The database has made it possible to establish a link between products and their use and helps the prevention service and individual inspectors to quickly identify a hazard by activity sector. It also provides a means, where there is doubt, of checking the labelling substances. It has provided a very useful tool to identify chemical hazards, in the first stage of risk assessment. It has been used by safety and medical officers in enterprises as well as prevention service inspectors and has become the most linked to part of the website. Having developed a successful methodology, the database can be extended to cover small enterprises.

Comments

Chemical databases can be useful tools if developed to reflect the real situation and needs of enterprises. Sector-specific information on the number, variety and amounts of hazardous chemical products used is also useful to authorities enabling for example the setting of priorities for action.

SEPPI
Système d'évaluation des risques
professionnels des produits chimiques

2.11 LABELLING RAW MATERIALS

WR GRACE SA

33 route de Gallardon
F-28230 Epernon
France

Tel: (33-2) 37 18 86 00

Issue

Development of a labelling and identification system for raw materials in the plastics and rubber sector, integrating health and safety phrases, hazard symbols, and personal protective equipment

Problem

Lack of information on the hazards of raw materials after replacement of original container (loss of manufacturer's information).

Solution

The development of a system to ensure that all raw materials remain labelled with safety information and that the information is always available to staff - the Hazardous Materials Identification System (HMIS). Regardless of the location where the materials are being handled, the information concerning protection of employees can be found on the packaging.

The system functions by standard HMIS labels that are fixed to each raw material, on receipt of the substance. The labels are produced from the HMIS database integrating:

- a hazard rating based on the NFPA standard (health, flammability, and reactivity);
- manufacturer's information (risk and safety phrases, hazard label);
- the personal protective equipment to be used.

After the system was devised, measures to implement the system included training all users of raw materials about the system and placing HMIS summary information on display boards in workshops and laboratories. Safety data sheets are archived and available for consultation.

Staff were assigned responsibilities for administering the system:

- The shipping manager/reception ensures that the appropriate HMIS labels are immediately affixed to raw materials coming in.
- Heads of department ensure that HMIS labelling procedures are complied with in their respective departments and inspect storage areas at regular intervals to ensure that the labels on the various containers are legible.
- Site managers ensure that the HMIS is properly monitored.
- The environment, health and safety coordinator ensures that the HMIS labelling procedures are checked regularly and that training is provided annually.
- The environment, health and safety department performs hazard evaluations so as to allocate HMIS risk gradings, which must be communicated to all sites. The EHS department is also responsible for updating HMIS categories by means of continuous checks on new materials and regular checks on materials already in use.

Containers located inside the plant are labelled as follows.

- The appropriate HMIS grade label is affixed to every chemical product container inside the plant, with the exception of finished products intended to be dispatched to customers. If applicable, the raw-material code must also appear on the data sheet (SDS) of the relevant product for reference purposes.
- An HMIS label is affixed to all containers received by the site. Identification or hazard labels affixed to containers by the supplier must not be removed or erased. Any pallet with close-fitting packaging may have labels affixed externally, at the top, middle and bottom of the pallet.
- An HMIS label is affixed to containers created within the site when they are put into service. The only exception to this labelling requirement relates to portable containers into which chemical substances are transferred from labelled containers, and which are intended for immediate use by the person who has transferred them.
- Notices, batch sheets or any other written material may be used for permanent industrial containers in place of labels, provided that the alternative method identifies the container to which it applies, the identity of the chemical substance, and the appropriate hazard warning.

Storage tanks and receptacles in racks of raw materials are labelled, both inside and outside, following the same principles. Raw material samples are also subject to labelling.

The labelling procedures training has been integrated with training on risks from dangerous substances, identification of hazards and precautions that workers need to take.

Results

Costs

- Printing system: EUR 6,000;
- Consumables (blank labels and print rolls);

- Display of the summarised HMIS (40 notices): EUR 1,800;
- Training (160 people): EUR 1,200.

Benefits have included

- Improved means of managing the handling hazardous materials and substances;
- Improved employer-employee relations through the introduction and use of material and organisational resources;
- A tool transferable to other branches of the enterprise.

An example of an HMIS label

Comments

The labelling system addresses a common problem: handling of dangerous chemical products on site often involving transferring substances from one container into another, or mixing compounds. This often leads to the loss of labelling information about hazards. Ensuring the new container is labelled with what it contains and the risks involved is therefore crucial for risk management. Communication of information to staff is important and a system such as this can form part of the communication process and is an essential part of the overall risk management approach.

2.12 GISBAU – AN INFORMATION SYSTEM FOR SMALL COMPANIES IN CONSTRUCTION

Arbeitsgemeinschaft der Bau-Berufsgenossenschaften

Hungerner Straße 6
D- 60389 Frankfurt am Main
Germany

www.gisbau.de

Issue

Chemical products used in the construction sector. Producing an understandable information system covering substitution, prevention measures, codes of practice and templates for operating instructions.

Problem

Many chemical products which can present health risks for workers are used in the construction industry and there are regulations concerning their use. However, many construction firms are small companies (90% of the German firms employ less that 20 people) that often do not have expert health and safety knowledge about the chemicals that they use. As a result, they often experience difficulties in fulfilling their obligations regarding risks from hazardous substances.

Even if the necessary information about manufacturers' products is available, it still has to be translated into working procedures. This applies above all to the many mobile working places found in the construction industry. Procedures that can successfully be applied at stationary workplaces, such as exhaust ventilation, can often not be implemented under the constantly changing conditions found on building sites. Providing these companies with practical, relevant information is a particular challenge regarding the amount and complexity of available information on the wide variety of products used.

Solution

Against this background, seven construction trade associations and the civil engineering trade association formed the GISBAU service (information system for hazardous substances in construction)[4] to offer support to its members. The information system involves:

- compiling appropriate, readily understandable information on products (mixtures of many individual substances) for SMEs in the construction industry;
- circulating the information via a free CD-ROM and the Internet.

In relation to construction activities, the system provides:

- product information;
- information on less hazardous products as substitutes;
- draft user instructions related to specific products and activities;
- concrete specifications in particular with regard to personal preventive measures;
- brochures and general instructions.

An important feature has been to make reliable and practical product and user information available electronically. The computer software also offers the facility to generate and administer a directory of hazardous substances and supports the preparation of individual user instructions for products that the system does not contain. A further component is a 'help; system with an extensive glossary of hazardous substances.

Many products, mixtures of chemicals, are used in the construction sector, so the GISBAU service has concentrated on compiling and providing product information related to the products used in the sector, and not individual chemical substances. Information from safety data sheets and technical notes is complemented by data referring to particular processes, including results of exposure measure-ments at workplaces. As an example, one particular adhesive for floor coverings may be used without taking specific measures, but a different

[4] Gefahrstoff-InformationsSystem der Berufsgenossenschaften der Bauwirtschaft

adhesive may only be used with exhaust ventilation or respiratory protective equipment. Since many products represent comparable risks to health, and therefore call for the same protective measures to be taken, GISBAU assembles the information on individual products into product group information, for example for adhesives. The result is that for a few groups information can be given regarding a large number of products of the same type.

A loose-leaf manual, brochures and leaflets have been produced to back-up the electronic system.

GISBAU information and guidance include:

- working in contaminated areas
- renovation of buildings and concrete constructions
- roofers
- coating removal (stripping) and alternatives to chemical stripping agents
- tile laying
- floor covering work
- cleaning buildings
- insulation - handling mineral wool insulation materials
- painting work
- laying parquet floors (primers and adhesives) and sanding work
- acid-proof construction
- wood preservatives
- wood glues
- the builders yard.

They have also provided input to codes of practice for the use of specific hazardous materials (TRGS – *Technische Regeln für Gefahrstoffe*), promoting the use of less dangerous products e.g. used as paint strippers, cements, floor covering adhesives or parquet sealant.

Specific information has also been prepared for different user groups:

Employers, inspectors, work council members, occupational health physicians, occupational safety specialists; and employees. Some guidance is available in other languages.

The information for workers is presented in the form of user instructions, which only need to be complemented by the company with data specific to the workplace and the particular operation.

GISBAU can also support decision-making regarding the selection of construction materials by architects, clients or building authorities.

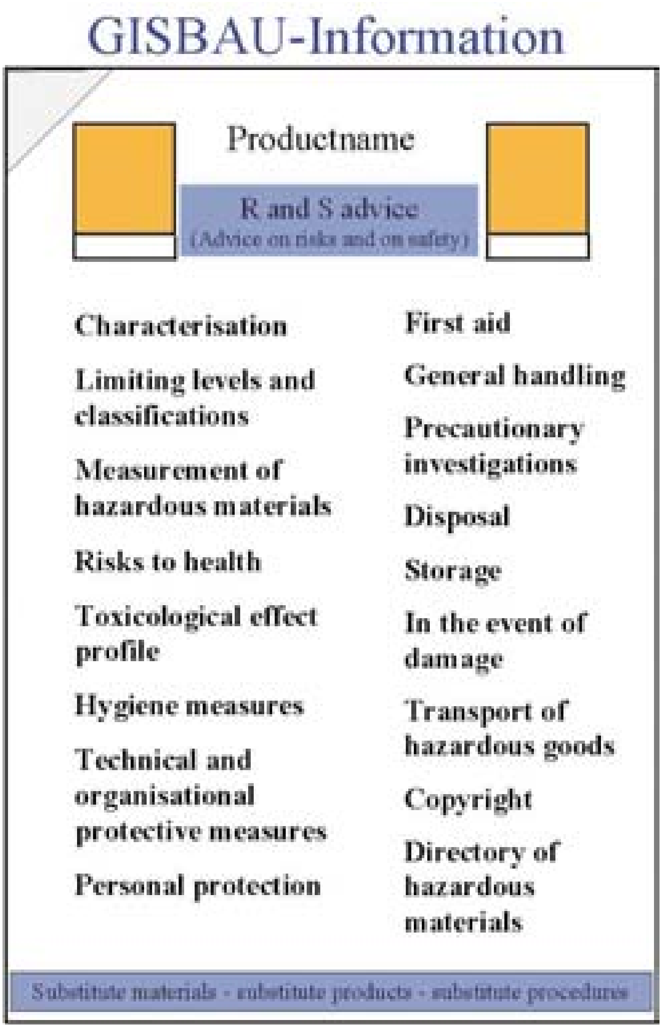
Results

The system provides useful practical information for small construction enterprises working on external worksites with constantly changing working conditions.

Comments:

SMEs often need resources adapted to their sector and specific to their circumstances, as in this case.

A more extensive description of the system, including the product coding and labelling system GISCODE can also be found in the Agency's case study report *How to convey OSH information effectively: the case of dangerous substances*, available at http://osha.eu.int/ew2003/.



2.13 ELECTRONIC RISK PREVENTION TOOL FOR CRAFT TRADES

Staatliches Amt für Arbeitsschutz Aachen (National Office of Industrial Safety, Aachen)

Borchersstr. 20
D-52072 Aachen
Germany

E-mail: poststelle@stafa-ac.nrw.de
The practical tool available at www.gefahrstoffe-im-handwerk.de

Issue

Development of an Internet-based, practical tool for small craft trade enterprises, taking the painting and varnishing trade as an example.

Problem

Many small and medium-sized enterprises (SMEs) come from the craft trade sector. The average number of employees in craft trade enterprises in the area covered by the office of industrial safety in Aachen is nine. The experience of the National Office of Industrial Safety, Aachen, and the Chamber of Craft Trades (*Handwerkskammer*), Aachen, and also the results of studies carried out by other institutions, such as the Federal Office of Industrial Safety and Industrial Medicine (*Bundesanstalt für Arbeitsschutz und Arbeitsmedizin*), show that craft trade enterprises often have problems in ensuring that hazardous substances are handled safely. These problems include the level of expertise needed to understand legislative requirements and limited resources in terms of personnel, time and finance.

Against this background, the National Office of Industrial Safety, Aachen, carried out a project aimed at achieving a lasting improvement in how hazardous substances are handled in craft trade enterprises.

Solution

The project was based on a partnership approach. It involved cooperation with the Chamber of Craft Trades Aachen, the Aachen Trades Association

(*Kreishandwerkerschaft*), the North-Rhine trade guild sickness fund (*Innungskrankenkasse Nordrhein*), the Technology Advisory Office of the NRW Confederation of Trade Unions - Cologne office (*Technologieberatungsstelle beim Deutschen Gewerkschaftsbund NRW e.V.*), the association of painters and varnishers, the association of building and construction workers, the association of joiners, the association of the motor vehicle and electrical engineering trade of the town of Aachen and the association of cleaning contractors of the Aachen region.

The project started with a survey in a number of craft trade enterprises carried out by the office of industrial safety Aachen to ascertain their needs. The owners wanted simple and effective support, legal requirements adapted to their circumstances and practical tools, forms etc. available in electronic format.

Practical guidance was developed and support arrangements established to meet these needs. It was decided to focus on one trade area initially: the paint and varnishing trade sector. The main objectives were to:

- make enterprises more aware of their own responsibilities;
- motivate them to take their own initiatives;
- support them to help themselves;
- reduce bureaucracy;
- build up a network of regional and supra-regional advisers;
- help them to prevent risks at an acceptable cost, in terms of time and money;
- provide them with assistance to call on when necessary.

The electronic tool consists of five steps.

1. How to recognise hazardous substances.
2. How to obtain EC safety data sheets.
3. How to lay out a list of working materials/hazardous substances.
4. How to prepare a user guide.
5. How to instruct employees.

Various resources include:

- a specimen letter to the supplier to request the EC safety data sheet;
- a register of working materials/hazardous substances with the commercially available materials;
- a model for preparing user guides;
- a simplified explanation of the regulations, related to their sector;
- information about handling hazardous substances containing asbestos
- information about regional and inter-regional advisers (telephne number, internet and e-mail addresses, fax number);
- links to other information sources.

The craft trade enterprises can adapt the resources, for example, to prepare their own user guides.

The tool is the first support stage. It enables the enterprises to assess for themselves when they should call on assistance from the cooperation partners outside their own company and tells them how and where these partners can be reached. In addition, back-up support was set up in the form of advisers to help the enterprises and clarify any questions they have.

700 painting enterprises in the area covered by the Aachen office of industrial safety, were informed about the Internet service by means of an information flyer. Training for enterprises about the Internet service took place at association meetings and separate events in the local districts. The participation in the project is free of charge.

The active cooperation of partners included promotion of the tool. For example, the North-Rhine association's (*Landesinnungsverband Nordrhein*) of painters and varnishers support included an article in its members' magazine. The Centre for the Environment and Energy of the Chamber of Craft Trades, Düsseldorf made a link to the tool on its web page.

Following the successful introduction of the practical tool for the paint and varnishing sector, the tool is being adapted to other sectors that were represented in the project as cooperation partners, such as other building trades, vehicle repairs, furniture-making and contract cleaning.

Results

The level of awareness and activity on prevention of dangerous substances in the targeted sector has improved. The cooperation between labour inspectorates and enterprises has been increased through this project.

Comments

The practicable and easy understandable resources are important for SMEs. When using such tools, it is advisable to define what is to be done to ensure that legal requirements are met. In a sector characterised by variable and external workplaces, a broad partner network as used here, that actively promotes the resources, will help dissemination and use amongst the targeted SMEs.

2.14 BITUMEN FORUM – LOW-TEMPERATURE ASPHALT

BITUMEN discussion group

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Issue

A cross-industry and expert group. Assessment and reduction of bitumen-related emissions during asphalt laying.

Problem

Road asphalt and mastic asphalt are laid at high temperatures (around 160°C and 250°C respectively). This creates fumes and aerosols that have a detrimental effect on asphalt workers which has not yet been fully assessed, although the possible health hazards have been the subject of discussion for several years. In addition, the German occupational exposure limit for fumes and aerosols emitted from hot bitumen, is a technical guidance value, which reflects technical state-of-the-art and is not primarily based on toxicological findings.

Rolled asphalt is primarily used in road construction. Open or tarpaulin-covered trucks transport rolled asphalt from the mixing plant to the construction site where it is processed by a paving machine. The paver distributes the asphalt evenly on the road and compresses the asphalt, which is brought into the final form by rollers. Laying temperature of rolled asphalt is around 160°C.

Mastic asphalt is used as floor cover in house building and for special purposes in road building. It is transported in heated mixer-vehicles from the mixing plant to the construction site and may be processed manually or by screed machines. Mastic asphalt, with a laying temperature of around 250°C, because of its

Rolled Asphalt	conventional asphalt 160 - 180°C 95 percentile of many measures	low temperature asphalt approx. 130°C results until now
Paver operator	6,5 mg/m³	0,4 - 3,1 mg/m³
Screed operator	10,4 mg/m³	0,6 - 6,9 mg/m³
Mastic asphalt	conventional mastic asphalt 240 - 250°C 95 percentile of many measures	low temperature mastic asphalt approx.205-230°C results until now
Charger, manual work	28,9 mg/m³	0,5 - 8,6 mg/m³
Smoother, manual work	35,8 mg/m³	0,6 - 10,8 mg/m³
Charger, mechanical work	61,4 mg/m³	1,3 - 7,8 mg/m³
Screed operator	40,6 mg/m³	1,7 - 11,1 mg/m³
Smoother, mechanical work	12,3 mg/m³	0,5 - 1,5 mg/m³

Table 1: exposure of the employees when working with conventional or with low temperature asphalt

greater fluidity, does not have to be compressed and may be stressed almost immediately after it has cooled. However, the higher laying temperature of mastic asphalt causes a high exposure of the employees to fumes.

Solution

Following support from the German Ministry for Labour and Social Affairs, the Bitumen Forum was formed at the beginning of 1997. All institutions whose members have an interest in, or are responsible for, applications of bitumen or bituminous products are represented in the forum. These include producers of bitumen, producers of bituminous products and users of those products such as roofers, road construction and other construction companies. The relevant institutions for occupational safety and health and trade unions are also represented in the forum. Companies and associations from other European countries also work within the forum. The forum's remit has included a programme to assess health hazards from bitumen and investigate solutions.

In particular, the forum has investigated the use of 'reduced temperature asphalt laying'. Reduced temperature asphalt laying primarily reduces exposure of the employees, but also saves energy, reduces carbon dioxide production and improves quality of the asphalt products.

Adding harmless additives to the asphalt, the temperatures are lowered for laying road asphalt (130° instead of 160°C) and mastic asphalt (210ºC instead of 250°C). The lowered temperatures result in significant reduced worker exposure to bitumen fumes, especially for mastic asphalt (see table 1). In addition energy is saved and less carbon dioxide produced.

Reduced temperature asphalt may be produced in different ways. One technique is based on the addition of zeolites to asphalt in the mixing plant. The zeolites


laying of low-temperature asphalt at Orly (France)

are the same as used in large quantities as substitutes for phosphate in washing powder. Zeolites release steam at temperatures between 100°C to 200°C. This leads to a foaming effect, which improves asphalt's pliability. In this way, rolled asphalt may be laid at considerably lower temperatures than usual (about 30°C).

The other ways to lower the laying temperature are based on adding organic substances like amid-waxes or paraffins. These methods may be used for rolled asphalt as well as for mastic asphalt. In this way, mastic asphalt may be processed at temperatures below 210°C.

On construction sites with low temperature asphalt laying there is no longer any 'blue smoke' any longer, nevertheless the asphalt product achieves the same finished quality.

The Bitumen Forum has promoted the use of low temperature asphalt mainly by disseminating information and by performing air monitoring on the construction sites. For example the level of exposure has now been measured for employees laying low temperature asphalt in France and there has been cooperation with expert groups from other countries.

Other work by the Forum to assess health hazards from bitumen has included:

- determination of the constituents of the different bitumen types;
- measurement of fumes and aerosols arising from work with hot bitumen;
- the search for suitable protective gloves for use in handling bituminous emulsions and solvent based bituminous products;
- supporting the German part of a European epidemiological study of the incidence of cancer in 'bitumen workers';
- possible absorption through the skin of bituminous constituents when dealing with cold bituminous products;
- investigation into dermal absorption of certain constituents from fumes and aerosols released from hot bitumen.

Results

Improved worker health: Using low-temperature asphalt, the high exposure of mastic-asphalt road workers to bitumen fumes, in particular, can be reduced to a level which is customary in other sectors. When using low temperature asphalt for rolled asphalt laying, exposure may be reduced to approximately half of the typical value.

Less strain on equipment and machines: lowering of the surfacing temperature results in improved durability and less 'weathering' of the bitumen. It is also better for the equipment used in the mixing and laying. Low temperature asphalt has better utilisation characteristics and for mastic asphalt, durability is increased up to 60%.

Reduced energy consumption and CO2 emissions: energy required is reduced by about 30% when the mixing temperature is decreased by 30 - 35°C. Less fuel oil is used and less carbon dioxide is produced.

Active cooperation and information exchange has led to shared efforts, practical solutions and effective dissemination of information.

Comments

The substitution of high to low temperature asphalt is one of the actions carried out in an elaborated programme aimed to cover all steps necessary for risk control. This includes risk assessment and exposure monitoring throughout the project, technical and organisational measures, but also an impact on regulations, such as occupational exposure limit setting. The broad partner network aims to ensure that all interests are covered, availability of expertise and also effective promotion of the results.

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2.15 AN AUTOMATIC LUBRICATION SYSTEM FOR THE EXTRUSION CHAMBER OF BRASS BILLETS

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Issue

Metal works sector. Substitution with boron nitride powder and automation to avoid exposure to talcum powder used as a lubricant.

Problem

In an extrusion chamber, a brass billet is heated and transformed into a bar. High forces and temperatures are involved in this process that can affect the behaviour of the press. One problem involved the shell of the billet becoming attached to the wall of the exclusion chamber after extrusion had ended, due to the enormous cohesion forces between the billet and the chamber. When this happened, an operator had to enter and remove the billet. The unacceptable hazards of this operation included exposure to high temperatures and injury from moving components of the press. To solve the problem of the sticking billets, industrial talcum powder was applied as a lubricant to the billets before they entered the extrusion chamber. However, the operator had to apply the talcum powder to the hot billet while the billet was being automatically loaded into the extrusion chamber. The operator had to be inside the moving component area of the press seconds before the beginning of the cycle and due to the high temperature of the billet, the talcum powder formed a cloud and was widely dispersed across the whole area. Although masks were used, after only four to five cycles the filters were clogged.

Solution

It was decided to substitute the talcum powder with a safer product, powdered boron nitride, which could be electrostatically discharged when sprayed.

Tests showed that the boron nitride powder was effective in preventing the billets sticking to the chamber wall. Next, an electronically controlled spraying unit (as used in electrostatic dying) was purchased that electrostatically charged the powder when spraying it, so that it would adhere to the nearest metallic parts of the press (i.e. the stainless steel extrusion chamber) and not be dispersed into the environment.

The automation also included mechanical and hydraulics designs so as to determine the best possible position where the whole system should be installed.

The spraying nozzle was brought as close as possible to the extrusion chamber by installing the automated system on the outer section of the extrusion chamber. From there, aided by a hydraulic piston, the spray nozzle was brought to within 3 mm of the extrusion chamber, thus facilitating the adherence of the boron nitride powder to only the inner section of the extrusion chamber.

Results

The lubrication is done automatically, avoiding operator exposure. Others in the factory area are no longer exposed to talcum powder. Improved lubrication has improved the machine life and reduced maintenance costs and automation has also reduced the press cycle, increasing productivity.

Comments

While eliminating one problem, a new hazard was created, that then required assessment and prevention.

2.16 GALVANISING: MODIFIED DEGREASING PROCESS TO REDUCE FUME EXPOSURE

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Issue

A new production process was put in place to reduce hazardous conditions in a galvanising plant for steel constructions.

Problem

Hot dip galvanising involves the immersion of iron or steel objects in molten zinc to apply a protective coating. This galvanising reaction will only occur on a chemically clean surface, therefore this needs to be free from grease, dirt and scaling. One of the common ways of degreasing is to dip the component into an alkaline or acidic solution. It is then rinsed and pickled in hydrochloric acid to remove rust and mill scale. After further rinsing, the components then normally undergo a fluxing procedure. This is normally applied by dipping in a flux solution – usually 50% zinc ammonium chloride – at around 65–80 °C. After drying, the clean iron or steel component is galvanised by dipping into the molten zinc, which is normally used at around 450 °C.

Exposure to fumes and vapours in the galvanising plant were causing concern for the employees' health and safety, and resulting in high levels of absence.

A risk assessment identified several hazards arising from this process.

- Acid degreasing: exposure to phosphoric acid vapours; high risk of injury from splashes.
- High hydrochloric acid – low iron chloride pickling solution: hydrochloric acid corrosive vapours, high risk of splashing.

- Fluxing in 50% zinc ammonium chloride at 60–85°C: ammonium chloride fumes.
- Galvanising: ammonium chloride fumes, risk of splashing.

The biological degreasing system

Solution

Previous attempts at solving the problem inside the galvanising plant had included installing roof fans to extract the fumes and vapours. However, these methods were never completely effective and the company realised that it needed to revise and improve its safety and health measures, including work organisation as well as working environment. At the same time it wanted to improve its environmental performance. It was clear that the alternative to collecting and treating waste process chemicals – producing huge amounts of sludge and hazardous fumes and vapours – is to avoid making them in the first place.

The activated pickling system

In close cooperation with external experts, the company set in motion a new galvanising process with two main goals:

- A clean working environment,
- No release of hazardous waste.

The new process involved a series of changes to the various process phases.

Hot-dip galvanising

Biological degreasing

The acid degreasing was substituted by a biological degreasing system. The new system operates in three steps: First, the grease and oil are removed from the parts and emulsified in the degreasing liquid. Second, the chemicals in the degreasing systems form an ideal environment for microbiological activities. Bacteria (*Pseudomonas alcaligenes*) are incorporated into the system with the aim of consuming the oil and grease through a biological process that produces only carbon dioxide and water. This also removes the need to dispose of the used degreasing bath. Third, there is an inhibitor effect from the degreaser. Together with the fact that it operates at pH 9, there is no need for rinsing between the degreasing bath and the pickling bath.

Only small amounts of sludge (containing inorganic materials) are produced. The degreaser operates at a temperature of 38-40 ^{0}C and a pH level of 9, which mean a very low risk of injury from splashes, and there are no phosphoric acid vapours.

The activated pickling system

A low acid-high iron chloride system (HCl 4–6%, Fe 140-190 g/l) was introduced to replace the high hydrochloric acid-low iron chloride pickling solution. The system works in a closed loop that only needs fresh acid and water.

From the environmental point of view, the system can be used continuously without producing any waste. It operates with a lower acid concentration (4–6% compared to 15% for conventional systems), which implies a reduced risk of injury from splashes and less hazardous fumes.

The continuousness flux regeneration system

This also works in a closed loop and is virtually a flux chemical production unit.

Zinc chloride ($ZnCl_2$) from the zinc-stripping process is recovered and re-used as flux salt. The flux is no longer a double zinc-ammonium chloride solution. The ammonium chloride (NH_4Cl) is replaced by non-fuming sodium or potassium chloride and the flux bath operates at 30–40°C compared to conventional 65–85°C. Again, the risk of injury from splashes and exposure to fumes is reduced.

Galvanising

The main problem with ammonium chloride (NH_4Cl) in the old flux process was that this salt decomposes at very low temperature, much lower than the temperature of the molten zinc in the galvanising bath. Ammonia (NH_3) and hydrochloric acid (HCl) recombine as micro or nanocrystals just over the bath.

Using non-fuming fluxing chemicals avoids the generation of fumes over the galvanising bath. This also means that no waste is produced, although there is still a risk of injury from molten zinc splash.

Results

Several aspects showed clear improvements as a result of the changes in the galvanising process.

- The levels of exposure to hazardous vapours and fumes were reduced to levels well below legal exposure levels.
- Risks of injury from splash were minimised.
- There is no waste released to the water stream.

- The general appearance of the galvanising plant is now very good. Cleanliness has become the rule and not the exception.
- There was a 50% reduction in the rate of absence during the first year of operation of the new process.

Other positive outcomes included higher staff motivation, better working climate, and better understanding of working procedures by management.

Comments

Improvements in health and safety are also often associated with better environmental care. It is important to consult and inform staff about any proposed changes, and to monitor the effectiveness of novel solutions to ensure that they do not cause any new risks over time.

2.17 ELIMINATING METHYLENE CHLORIDE FROM BITUMEN BINDER TESTING

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Issue

The manufacture of asphalt-coated road stone materials for use in the construction industry to construct new roads. The standard for quality assurance controls of asphalt included periodic testing of the material to ensure the quality of the binder and that the correct aggregate has been used, using methylene chloride to remove the binding material from the aggregate. The solution involved introducing a laboratory oven for the testing of bitumen binder that did not require the use of methylene chloride.

Problem

The effects of acute (short-term) exposure to chlorinated solvents include: harmful if swallowed or inhaled and may be harmful by skin contact; eye and skin irritant; readily absorbed through the skin irritant; readily absorbed through the skin; asphyxiant; light-headedness, drowsiness, headache, giddiness. Methylene chloride causes central nervous system depression and is a suspected carcinogen. It has also shown experimental reproductive effects.

Workers were at risk of exposure through absorptions, inhalation and ingestion whilst performing the test. Other associated risks included: contact with moving vehicles and environmental pollution due to accidental spillage, fire/explosion from heat source during storage, unloading and transportation.

To carry out quality control, as described in the standard, required the use of methylene chloride. The laboratory technician had to decant methylene chloride into a container from a drum, for use in the laboratory for testing.

The container was taken to the laboratory. The sampling method requi-red six tests to be undertaken daily, which involved further decan-ting from the container into a metal container, where coated asphalt was added and placed on a roller for 30 minutes to allow the material to separate. The contents were then sieved through the vacuum pump, which removed the bitumen and methylene solution, and discharged it. The solution was then periodically distilled and the methylene chloride would be re-used.

Old testing method: where a worker pours bitumen and methylene chloride solution into the vacuum pump. The waste methylene chloride was then discharged into a container below the fume cupboard

The aggregate, once sieved, was placed in a ventilated cabinet, to remove the remaining methylene chloride. During this process, fumes were still given off from residues of methylene chloride on the aggregate. Throughout the process, laboratory technicians were provided with, and wore, chemical resistant gauntlets, chemical resistant safety goggles, half face filter masks with two filter cartridges suitable for the use with methylene chloride and chemical resistant footwear and aprons.

Approximately 50 litres of methylene chloride were distilled at a time. After distillation, a plastic container containing the waste substance (residue of bitumen and methylene chloride) was taken back to the chemical storage area and transferred into a drum. This would then be treated as contaminated waste and disposed of by a licensed contractor.

Solution

Identifying risks

A risk assessment was undertaken of all operations and activities involved in the transportation, storage and handling of methylene chloride. A number of risks were identified in addition to exposure to the chemical.

The risks included:

During unloading:

- environmental contamination from unintentional discharge of the substance during unloading;
- the plant operator coming into contact with reversing vehicles;
- fire/explosion from unintentional release of the substance coming into contact with a heat or ignition source;
- foot injury from 200 litre drums falling during unloading.

During storage:

- cross contamination with other substances resulting in the introduction of fire and explosive risks;
- environmental contamination from unintentional discharge of the substance from corrosion of the storage container;

- fire/explosion from unintentional release of the substance coming into contact with a heat source.

During handling:

- inhalation, ingestion and absorption of the substance from accidental contact during unloading, transportation, decanting and handling the substance during testing;
- fire during decanting and contact with a heat source during testing in the laboratory;
- eye injury from accidental contact with the substance.

The risk assessment review involved observation of the process and consultation with the workforce as well as obtaining information from the manufacturers of the substance, and reviewing information contained on the safety data sheets and product information sheets.

Determining effective control measures

The company had recently, for the first time, introduced a formal safety management system and monitoring arrangement. Short-term and long-term control measures were set. This included changing the process, with the agreement of the plant manager and persons involved in the activities. An example of a change was to undertake all of the decanting and testing inside the fume cupboard.

Consideration was given to risk transfer, by sending the samples to an external testing laboratory, to reducing exposure to the workers. However, recent technological changes to how the sample testing could be carried out, and flexibility that had been introduced to the tandards, allowed a complete review of the process and introduced the possibility of eliminating the use of methylene chloride completely. A review was undertaken to establish whether alternative testing facilities were available.

Following the consultation process, a specialised oven was obtained, which enabled the material to be separated, by burning the bitumen away at high temperatures. Whilst risks were still present from possible contact with hot substances, the process change eliminated the use of a carcinogenic substance and drastically reduced the risk of serious ill health, fire, physical injury and environmental pollution.

Results

There were more effective controls over working conditions and the improved working environment also helped to develop the safety culture. The resultant waste products were also less hazardous. The cost of purchasing methylene chloride was eliminated and consultancy and health surveillance fees reduced. The new testing method was also quicker

New, safer method using the oven

Introducing the new furnace has meant:

- In addition to quicker binder recovery and results during testing, fewer resources are required to undertake testing, resulting in a significant saving on labour costs. The laboratory technician is free to undertake other operations whilst the sample is in the oven – a possible saving on labour costs on average of 3–4 working hours per day;
- A safer process achieved at a relatively low cost, EUR 10,000.
- Savings on the cost of replacement filter. Filters cost saving of EUR 330 per annum.
- Longer-term costs will be measured against the initial cost of purchasing the equipment, against the cost of purchasing and maintaining the personal protective equipment and the cost of monitoring arrangements. Monitoring costs would be approximately EUR 3,600 per annum. (based on 6 hours per month by the internal health and safety coordinator).
- Costs of health surveillance and consultancy fees for monitoring exposure levels have been significantly reduced, the saving in consultancy fees is EUR 3,600 based on one half day visit per month by an external consultant.
- Cost of purchasing methylene chloride and the cost of disposal of the waste product eliminated. Cost savings of EUR 2,000 purchase cost per annum and EUR 1,000 disposal cost per annum;
- The likelihood of sickness absence has been reduced.
- A better working environment has increased safety awareness in the workplace and development of the safety culture.

Comments

Follow-up evaluation is important to check that the solution is effective and that the expected results have been achieved.

2.18 REDUCING ETHYLENE OXIDE EXPOSURE DURING STERILISATION: MEDICAL DEVICE MANUFACTURING

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Issue

Manufacturing medical devices, which require sterilisation prior to shipment using a powerful agent.

Problem

Ethylene oxide is an effective bactericidal. But it can also cause severe eye, throat and nose irritation, skin burns and, allergic sensitisation. It is toxic by inhalation, ingestion and through skin contact and known to be a carcinogen, mutagen and reproductive hazard. Therefore both acute and low level, long term exposure are an issue.

A modern plant had been introduced a few years previously, and exposure levels in the sterilisation area were already meeting the legal limits, but the company wanted to reduce them still further.

Solution

The objective was to reduce ambient exposure levels of ethylene oxide in the steriliser area from the national legal limit of 5 ppm to an internal goal of 0.5 ppm. using engineering controls. A project management team was established with a specific remit to review ethylene oxide levels and formalise a strategy to reduce them to at least 1 ppm and, if possible, to 0.5 ppm. The management project team included the health and safety officer, the environmental officer, human resources specialists, the purchasing officer, and staff from the warehouse (the sterilising plant is located in the warehouse area of the plant) and utilities. Internal engineering, quality and facilities expertise was also made available to assist the project. The terms of reference for the project were:

- identify deficiencies in the current system;
- propose corrective actions for reducing ETO personnel exposure;
- implement, monitor and review.

The team planned a strategy that set short, medium and long-term goals. The strategy included:

- monitoring and recording ethylene oxide levels on a daily basis;
- weekly reporting;
- a weekly project review;
- setting realistic timetables;
- bench-marking with similar industries;
- on-going communication with personnel.

They set up a separate task team primarily to review the personnel protective equipment (PPE) being used and look for a suitable alternative. While the general performance of existing PPE was satisfactory, there were occasions in specific areas where exposure levels for short periods were too high for it to cope with (ethylene oxide levels greater than 10ppm). The task team:

- conducted a brainstorming session with all involved to propose a list of possible solutions;
- meet and discussed the problem with key environmental and safety and health people within the company and from external authorities;
- set phases for implementing the proposal;
- generate employee awareness and participation in each phase of the project and highlight any specific changes that may have occurred.

The solutions were implemented in three stages (see figure 1)

Both health surveillance and exposure monitoring were used to inform the project and to review its success. The monitoring is part of ongoing occupational health and hygiene programmes.

Results

Having achieved the project aim to reduce exposure levels of ambient ETO at source from the National Legislative Limit of 5ppm to an internal goal of 0.5 ppm, monitoring results indicated the level to be as low as 0.1 ppm in certain areas.

Comments

Good planning, management commitment, employee involvement and the use of competent occupational health and hygiene services are important aspects of successful project implementation. The project has aimed to ensure that exposure is reduced to a minimum below the permissible exposure level, a general prevention principle that should applied for particularly hazardous substances such as carcinogens.

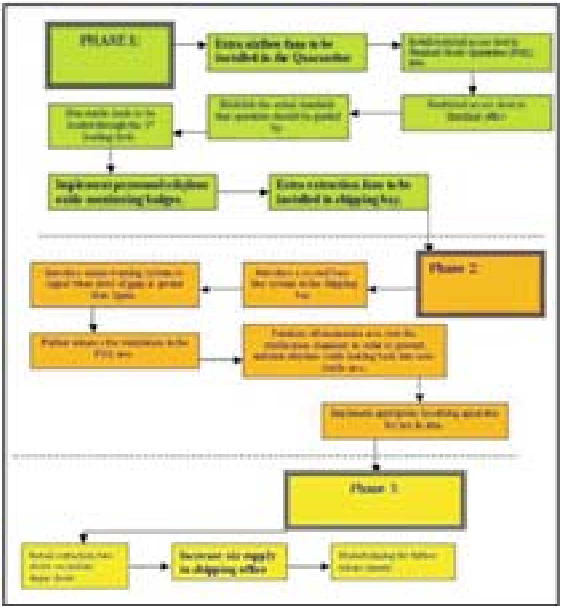

Figure 1: Solution implementation stages

2.19 PREVENTING EXPOSURES IN VEHICLE REPAIR

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Issue

Painting vehicles in the bodywork shop and changing the engine oil in the repair workshop.

Problem

A risk assessment indicated two areas with the highest risk of workforce exposure to dangerous substances:

Bodywork shop

Several risks are present in this area: when re-painting vehicles, the worker is exposed to harmful substances (both air-borne particles and through skin contact). Problems include solvents, isocyanates, styrenes in polyester-based putty, spraying of paints and varnishes, manual cleaning of the spray gun, dust from polishing and sanding operations, and catalysts used to prepare primers and fillers and undercoats containing isocyanates.

Repair workshop

Contact with engine oil, especially used oil during replacement that can be contaminated by carcinogenic substances and can cause other health effects such as dermatitis.

Solution

These problems were discussed with the occupational physician and also with the workforce affected, informing them about the specific hazards involved.

Afterwards, a decision was taken to implement various measures. The changes were backed-up with information and training for workers.

Bodywork shop

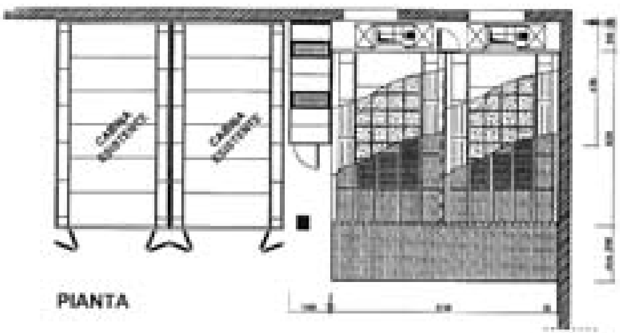
The most important issues to address were:

- Adapt work environment: adequate space and cubic capacity; removal of sources of pollution, including product storage; providing automatic washing machines, at least for spray guns; and insulated vacuum colorimeter units.
- Review choice of products: in particular hardeners with high levels of free isocyanate monomers and thinners with significant concentrations of organic solvents.
- Correct operating procedures: aimed at preventing the staff coming into contact with dangerous chemical compounds.
- Stringent use of PPE (personal protective equipment).
- Training and information dissemination.

The company decided to replace solvent-based products with water-based ones, and also to introduce changes to operating procedures when preparing and spraying paint or varnish on vehicles. Changes included:

- installation of:
- pre-processing areas at two vehicle positions for dry sanding and spraying;
- a drying system using infrared rays leading to the integration of the two conventional-type furnaces;
- an exhaust ventilation device for polishing and spraying using activated carbon black to the conventional painting and varnishing bays.
- introduction of water-based products;
- installation of two automatic compressed-air spray gun washers which use only detergents and mildly abrasive solvents. The first is used for water-based products and the second for cleaning the same spray gun when used for spraying transparent coatings (still solvent based).
- use of mild solvents and detergents with airbrush washers.

Throughout the process, the workforce played an active role in implementing the changes



Repair workshop

A new distribution system was implemented with the aim of optimising the management of oil by means of a closed circuit for both clean and used oil. At each stage of the work, the oil to be changed is drained away through sealed tubes that take it directly into the collection tank. The circuit was completely isolated, eliminating the need for manual handling, thus avoiding any spills on the floor or contamination affecting the workers.

Results

Implementation has led to more efficient use of the warehousing colorimeter unit, and better management of dangerous substances. The innovations introduced have reduced the workers' exposure to chemical risks, and in particular the use of solvents, by 75%. Despite these improvements, a residual chemical hazard still remains. This involves the inhalation of isocyanates, which, despite low concentrations following implementation of the measures, continues to represent a hazard.

The use of water-based products does not affect the production systems adversely when compared to traditional methods.

Reasons for using water-based products

1. Health protection for staff working in bodywork shop.
2. No need to change work habits: paints are mixed in the same way as before.
3. Conventional bays can accommodate the use of water-based paints and varnishes.
4. Simple preparation, easy application.
5. Additives and activators are not required.

6. Dilution not required.
7. Considerable enhancement of work processing times.
8. Improvement is in line with European 'VOC' regulations on low solvent emissions.
9. Small quantities can be mixed, ensuring minimum waste.
10. Residues can be used down to the last drop.
11. Material undergoes correct rotation, product warehousing costs are kept to a minimum.
12. Excellent rendition of colour can be obtained.
13. The process leads to a superior coating with a far more economical use of resources.

The distribution system for fresh and used oil has significantly improved processing and run-times, and the current situation may be considered more than acceptable.

The cost of implementing the new working procedures was about EUR 60,000 for the bodywork shop, and about EUR 20,000 for the repair workshop. However, the direct and indirect benefits are clear with regard to protection of the workforce and the environment. At the same time, the changes have guaranteed the quality of the products manufactured. Finally, the above reorganisation of work procedures has improved both the working atmosphere and the work efficiency and production yields and workers expressed a greater feeling of 'confidence' in their work.

Comments

A relatively small enterprise has obtained good results from a comprehensive action. This included substitution and some new equipment, but also the re-organisation of work and information and training initiatives.

2.20 ELIMINATION OF N-N DIMETHYLACETAMIDE: SEMICONDUCTOR MANUFACTURING

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Issue

A chemical used in the manufacture of silicon chip semiconductors, which had been initially chosen as a substitute, N,N-dimethylacetamide, was later reclassified as a reproductive hazard and substituted with oxalic acid.

Problem

One of the many phases in the semiconductor fabrication process is the washing of the silicon element with various chemicals.

Following evaluation, one of the chemicals involved in these operations, that contained hydroxylamine (HDA), was substituted by a product based on N,N-dimethylacetamide (DMAc) both to improve productivity and employee safety and health. The use of the new solvent also eliminated the use of isopropyl alcohol with added carbon dioxide at the rinsing phase. The chemical could also be used at room temperature instead of having to heat it to 75°, reducing the rate of evaporation.

Employees had to manually load the chemical into closed processing chambers, the chemical was then automatically dispensed inside the processing chamber, by spraying, and an extraction system was used to remove vapours.

Following classification of N,N-dimethylacetamide (DMAc) as a ‘Reproductive Toxicity Category 2’ substance with a risk phrase of R61 (‘may cause harm to the unborn child’), the company also wished to eliminate its use. This decision was both to ensure compliance with legislative requirements and to implement company policy on avoiding the use of carcinogenic, mutagenic and teratogenic substances.

Solution

A specially formed company chemical committee company plays an important role in the management of hazardous substances. It has to authorise the use of substances, including those used by external contractors and independent workers in the plant. It makes its evaluations available to other company sites.

The chemical committee instigated a project to evaluate the use of N,N-dimethylacetamide and draw up an action plan, with the ultimate aim of eliminating the use of N,N-dimethylacetamide from the production cycle.

The chemical committee coordinated its work with the various internal and external parties involved, such as the management group, process engineering, prevention and protection department and medical authority, workers' safety representatives, suppliers of chemicals, equipment and plant, and the analysis laboratory.

Following evaluation by the chemical committee, the management decided that they should stop use of N,N-dimethylacetamide. This decision had serious repercussions regarding the progress of some products undergoing manufacture, as there was no similarly efficient alternative readily available.

The use of N,N-dimethylacetamide

When evaluating the risks derived from the use of N,N-dimethylacetamide, the following aspects were examined in depth:

1. Equipment.

The type of equipment that was available and compatible with N,N-dimethylacetamide was investigated to find a better alternative. New equipment was identified offering an improvement in terms of:

- the reduction of exposure to vapours during loading, by using a loading system with a double access door separating the process chamber from the area in which the operator performs the loading;
- various sealed containment systems affording greater protection from accidental leaks; and
- an automatic line and filter washing system allowing complete elimination of chemical residues before their periodic replacement.

2. Method of dispensing the chemical.

To minimise the risk of exposure to N,N-dimethylacetamide, a new dispensing system was introduced, its main advantages being the use of 200-litre drums (rather than 20-litre) to reduce the frequency of drum replacement.

The connection of the drum to the dispensing line is via an encoded, quick-release coupling to prevent both exposure of the operator during drum replacement and the possibility of connecting up the wrong chemical. Several additional safety mechanisms such as a vapour extraction system, containment tank for accidental leakage, leak monitoring sensor, and shutdown systems in the event of malfunction or emergency were also installed.

3. Methodology for carrying out environmental checks and biological monitoring of exposed workers.

The company consulted with experts and its usual suppliers to ascertain methods to use for both environmental analysis and biological monitoring of exposed operators.

4. Measurement of worker exposure to the chemical.

Periodic preventive controls to determine workers' level of exposure were carried out by an external specialist. The controls were performed at different points of the production cycle, including baseline measures prior to reintroduction of the chemical and a second series of checks four days after the initial controls.

5. Discussion of the results of the analyses and definition of the necessary precautions

Although the measures applied controlled exposure well within recommended levels,

the chemical committee decided that the substance should only continue to be used until the use of a new, lower-risk product (dilute oxalic acid) could be evaluated, and only under the following conditions: the use of latest-generation equipment; weekly environmental monitoring; limiting access to males only; consulting the workers' safety representatives; and informing the workers involved of the risks linked to the use of N,N-dimethylacetamide.

The introduction of oxalic acid

An investigation was carried out to look for alternatives to N,N-dimethylacetamide. It was found that dilute oxalic acid could be used instead in the same equipment. A full evaluation was carried out on the use of this substitute, and priority was given to this evaluation process, in order to eliminate the use of N,N-dimethylacetamide as quickly as possible.

Results

Dilute oxalic acid was found to perform equally as well as N,N-dimethylacetamide, while reducing the risks to workers. The results achieved were communicated to the company's other production sites and made available to the industry's scientific community.

Comments

The introduction of a company chemical committee and a formal approval procedure for the use of hazardous products ensures that the risks posed to workers are reviewed on a regular basis, taking into account new findings about the chemicals in use. It is also essential to review the risk assessments to ensure that substitutes are not found later to pose a risk themselves.

2.21 REDUCING DERMATITIS AMONG HAIRDRESSERS

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Issue

Reducing exposure to skin allergens during hairdressing tasks (washing, cutting, colouring, setting a permanent wave, blow-drying).

Problem

Hairdressing is associated with dermatitis (eczema). About 30 to 50% of hairdressers are affected at some stage of their career. Apart from the unpleasant appearance, and the physical discomfort and pain of dermatitis, it often means they have to leave the profession and find other work.

Solution

The government (Ministry of Social Affairs), employers and employees representatives agreed that they wanted to see a major reduction in the number of new cases of dermatitis among hairdressers setting a target of a 50% reduction by the year 2005. They decided to draw-up a covenant (voluntary, national agreement) for the sector, setting out targets and measures that needed to be taken to tackle the problem. The covenant places obligations on employers to provide safer workplaces, employees to follow safe work practices and manufacturers to modify their products to prevent skin contact with their products.

The covenant covers a wide range of measures, such as:

- gloves to be worn when mixing, applying and rinsing out colouring, permanent wave and highlighting agents;

- gloves should be worn when washing hair, whenever possible. Disposable PVC gloves should be used as latex gloves are also associated with allergies;
- hairdressers' products containing GTG (glyceryl thioglycolate), primarily permanent wave agents, to be prohibited;
- the packaging of permanent wave agents to be modified to minimise skin contact. Hair colouring packaging to be modified;
- only permitting the use of dustless or low-dust highlighting agents in the form of tablets, creams and granules;
- introducing rules about breaks and task rotation to prevent extended working with wet hands, as wet hands increase the risk of skin complaints;
- developing a screening instrument to enable hairdressers to determine if they suffer from hairdressers' dermatitis or are likely to be affected by it.

An important issue concerned the adoption of these measures in salons. The covenant was therefore backed up by a campaign to encourage its take up: 'Healthy Hairdresser: your health counts'. This included:

- sending hairdressers a quarterly magazine at home about dermatitis with tips about using gloves, etc;
- developing a CD-ROM;
- commencing the campaign with a 'preview tour' of nine theatre shows throughout the Netherlands. Hairdressers saw the shows in the evening while the trainee hairdressers saw them in the afternoon. A lively show with music, dance, and sophisticated lighting was used to present the latest fashions in hair while also covering hairdressers' postures at work and the use of gloves. About 10,000 people saw the preview tour, and all of them received a pair of vinyl gloves and the 'Healthy Hairdresser' CD-ROM.

Results

Both sides of the industry aim to reduce absenteeism as well as staff turnover through a healthy work environment.

A cost/benefits study indicated that if a salon implements all the measures it should save approximately EUR 6,000 per year.

Comments

Sectors with a high proportion of micro-enterprises, such as the hairdressing sector can be difficult to reach. Formal agreements to improve working conditions were backed with innovative approaches to get the message into workplaces and to workers. A specific effort was put into active dissemination to the enterprises and the workers involved, including apprentices. Showing the costs of non-compliance and benefits of the preventive measures can promote acceptance by the SME owners.

2.22 AUTOMATED MANAGEMENT SYSTEM

FOCWA

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Issue

Introducing an electronic knowledge databank and risk assessment system to assess, manage and monitor health and safety and environment risks in vehicle crash repair companies.

Problem

Crash damage to car bodies is repaired by specialist companies, body shops, most of which are members of the FOCWA trade association.

Body shops have a primary business process which includes the following steps:

- disassembly
- chassis alignment (jig work)
- measuring
- panel beating or replacement
- preparation: sanding, etc.
- spraying: primer and finish coat
- installing previously removed and new parts
- final inspection.

During some of these stages employees are exposed to dangerous substances including solvents, welding fumes and sanding dust:

Solvents

Body shops use products containing volatile organic substances such as the solvents in paints and coatings. Short-term, high-level exposure (in the order of minutes to hours) can lead to immediate effects on health such as irritation of the eyes, skin and respiratory tract, headaches and dizziness. These effects disappear when exposure ceases.

Long-term exposure can affect the central nervous system. This condition is known as 'painters' syndrome' or more technically as organic affective syndrome or chronic toxic encephalopathy. Symptoms include fatigue, impaired concentration, dizziness, memory impairment, impaired sense of smell, headaches, depression and personality changes. There may be irreversible health effects.

Welding fumes

Welding processes produce harmful fumes. These originate from the weld pool or filler metal and consist of fine particles. Short-term exposure to welding fumes leads to irritation of the eyes and respiratory tract. Metal fumes fever may also occur, due to the inhalation of fumes, zinc, manganese and copper alloys. Long-term exposure to chromium and nickel (welding stainless steel) or cadmium (brazing) may lead to cancer. Exposure to lead in old paint (e.g. lead primer) may lead to kidney and liver damage.

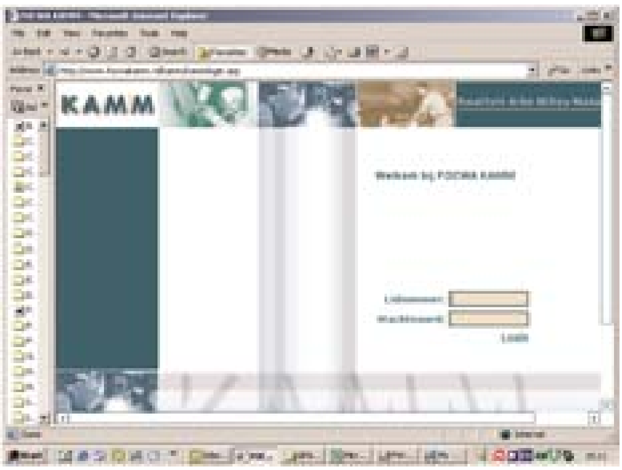
Sanding dust

Dust released by the dry sanding of paint, filler, etc. may be objectionable and/or harmful when inhaled. The harmful effects on health due to inhalation include irritation of the eyes and respiratory tract. Depending on the composition of the dust, high exposure levels may also lead to serious effects such as lung, kidney and liver damage (due to lead compounds contained in the paint) or cancer.

Solution

FOCWA KAMM system

As both the operations in body shops and the legislation and regulations affecting them are becoming increasingly complex, the body shop section of FOCWA decided to develop a management support system for its members. The KAMM system is an integrated database, which contains legislation,



regulations and other information relevant to body shops in the areas of quality management, health and safety and the environment. The system also provides an instrument to assess to what extent a body shop meets statutory requirements concerning environmental and health and safety management, as well as the requirements of KZS, the industry's quality management system.

The KAMM system consists of two parts:

1. Undertaking internal risk assessments and evaluations on the basis of questionnaires that can be tailored to each business ('scans').

2. The presentation of the results in a report suitable for sending to the external health and safety service, *Arbodienst*, for their validation, a list of problems, and the digital diary planner for setting deadlines for the measures to be taken and monitoring.

Where necessary the risk evaluation 'scans' can be limited to issues related to dangerous substances. In addition to the questions, the operator is presented with a list of measures to address any problems identified. These include:

- an instrument for the employer to determine to what extent personnel are exposed to dangerous substances (guideline for the management of the exposure to dangerous substances in body shops);
- instructions about handling dangerous substances;
- background information about the use of personal protective equipment;
- miscellaneous information about the storage of dangerous substances (store, safe, cabinet, etc.).

If a shortcoming is found then the KAMM system can provide information, in the form of recommended management measures, to resolve the problem. The digital diary is used to monitor the implementation of the measures and record completed tasks. Once the KAMM contains enough information the diary monitors the progress of the work to be carried out. The diary can be used to monitor the following issues and bring them to the attention of the user:

- person responsible for the implementation;
- person with the final responsibility;
- practical solution for the problem: the management measure;
- implementation deadline;
- warning that the deadline is approaching.

The KAMM system includes an industry-specific checklist for the implementation of the risk assessment and evaluation in body shops, which through the 'scan' can be made specific to the company. It includes data entry forms, for example, for entering and analysing absenteeism due to illness. In addition, the FOCWA trade association regularly provides users with new health and safety data by intranet link.

Results

The use of the KAMM system is helping companies to take a systematic approach to issues such as workplace conditions and absenteeism and consider them appropriately. It provides a ready made integrated management tool that can be made specific to the company, and reduces the need for the company to engage external support for the risk assessment and evaluation, thus saving the company time and resources.

Comments

An occupational health and safety system has been combined with a quality management system to create an integrated approach. It is important that such systems can be made specific to individual company needs.

WAT IS KAMM?

De wet- en regelgeving op het gebied van arbo- en milieuzorg is erg complex. Het voldoen aan alle eisen en richtlijnen vraagt van u als ondernemer vaak veel tijd en inspanning. Om u hierbij optimaal te ondersteunen, heeft de sectie Schadeherstel van FOCWA het KAMM-systeem ontwikkeld, dat geheel is toegespitst op de situatie in het schadeherstelbedrijf. Met andere woorden: KAMM is de vertaling van de wetgeving met een "branchesaus".

Door gebruik van het KAMM-systeem kunt u veel tijd besparen. Want om er zeker van te zijn dat alle onderdelen van uw schadeherstelbedrijf worden getoetst aan de wet- en regelgeving, zijn in KAMM alle afzonderlijke disciplines van de bedrijfsvoering ondergebracht. U kunt al deze disciplines in uw bepalen welke disciplines u op welk moment doorneemt. U kunt dus uw eigen route door het systeem heen bepalen. Flexibel en volgens uw eigen tempo. Ook hoeft u niet te onthouden welke discipline(s) u al heeft doorgewerkt, want dat houdt het systeem voor u bij. Alles is er aan gedaan om het u zo makkelijk mogelijk te maken!

2.23 REDUCING RISKS FROM GLUE VAPOURS

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Issue

The exposure of workers to harmful vapours from gluing processes during the production of isothermal boxes was reduced through a change in working procedures.

Problem

Jorge Honório Da Silva e Filho produces isothermal boxes for transporting food. During the company's general risk assessment activities, a problem was identified in the section where glue is applied to the panels that make up the isothermal boxes.

Each panel is composed of several layers of polyurethane and fibreglass. They were glued together with a styrene-based resin. The entire gluing procedure comprised four sub-tasks:

- Preparation (about 1 hour): a worker prepared the glue by mixing the catalyst, the accelerator and the carbonate of calcium with the resin, stirring them manually to blend them into a homogeneous mixture.
- Application to the resin base (1.5 hours): two workers used a spraying device to pour the glue over the constituent elements of the panels placed in top of the glue tables.

- Drying (6 hours): the panel was kept pressed down and monitored regularly.
- Cleaning (1 hour): all the equipment used was cleaned with acetone.

The assessment revealed that the main risks of the task related to exposure to styrene vapours (preparation and application sub-tasks) and to acetone vapours (cleaning). The toxicological effects associated with these substances include irritation of the skin, eye, and upper respiratory tract, and gastrointestinal effects. Chronic exposure may affect the central nervous system showing symptoms such as depression, headache, fatigue, and weakness, and can cause minor effects on kidney function and blood. Styrene is classified as a possible human carcinogen by the International Agency for Research on Cancer (IARC). Acetone can also cause serious respiratory problems.

Solution

The company included some modifications to the working procedures of the gluing section within its risk prevention programme 2001-2003. The proposed changes were discussed at the health and safety committee, and there was agreement to implement both short- and medium-term measures:

Short-term

- Inform the exposed workers about the potential risks.
- Provide training about prevention measures that they should observe.
- Display the relevant safety data sheets in the storage and work areas for consultation by the workers.
- Acquire proper containers for clean acetone and dirty acetone, to allow recycling.
- Acquire personal protection equipment appropriate for the existing risks.
- Limit the number of exposed workers.
- Provide exposed workers with specific six-monthly health checks, in addition to the standard health surveillance.

Before: resin spreading with rollers

After: application of polyurethane glue

The company carried out investigations to identify longer-term technical solutions that changed the work methods and/or products for others which were harmless or less dangerous. The investigations included demonstrations of new equipment and alternative products, and examining the published scientific literature on those products and methods. It was decided to adopt the following measures:

Longer-term

- Glue preparation: a closed-circuit procedure, with automated cleaning features, was brought in to replace the open-air procedure. This involved substituting the styrene-based glue resin for polyurethane glue. Although this product is still a hazardous substance, unlike styrene it is not volatile at room temperature, and its use together with the new work system for preparation, application and cleaning meant a reduction in risk:
- A system of ventilation and air renewal was implemented as a collective prevention measure.
- Workers were also advised to use the appropriate personal protective equipment, in accordance with the safety data sheets for polyurethane glue.
- Specific health surveillance was introduced for exposed workers, which included monitoring for the appearance of symptoms of asthma, and the levels of relevant biological markers in urine.

Results

Benefits from the new arrangements include:

- The new polyurethane glue is prepared in a closed circuit, and therefore exposure to harmful substances has been eliminated in this part of the process.

- A volatile product has been replaced with one that is non-volatile at ambient temperature.
- The new glue is applied via a closed circuit through pipes placed directly above the panel surfaces. The time required for this task has also been reduced from one and a half hours to one hour.
- Cleaning is also carried out automatically in a closed circuit, removing the need for workers to use acetone.
- Fewer workers are involved in the process, thus reducing the number of exposed employees.
- New work practices meant that the overall exposure times were reduced from four and a half to three hours.

In addition to these health and productivity benefits, there are also financial advantages for the company. For example, two subtasks (preparation and cleaning) have been eliminated, with a saving of two hours. Changes to the application phase led to a further reduction of one and a half hours.

Comments

Consultation with the workers involved in the process should always be a feature of this type of intervention. This helps to ensure the sustainability of any measures taken, it may identify some unintended consequences of proposed changes, and it also raises awareness of the risks involved.

2.24 TRAINING CLEANING WORKERS TO PREVENT CHEMICAL RISKS

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Guide available at: www.istas.net/sl/ip/limpieza.pdf

Issue

Implementing a training programme for worker representatives in the cleaning sector.

Problem

There are 8,500 enterprises in the cleaning sector in Spain, and 80% of them deal with the inside of buildings. They employ 246,000 workers, 70% of whom are women. Cleaners have to work in office buildings, health centres, industries, slaughterhouses, shopping centres, private residences, etc. The areas to be cleaned include offices, bathrooms, kitchens, gardens, corridors, stores, factory premises, operating theatres and many more. The surfaces can vary from metal, glass or plastic, to tiles, wood, fabrics, etc. If we add to this variety of workplaces, spaces and surfaces the different types of dirt and materials they have to deal with (soil, dust, grease, paint, food, needles, etc.), then it is easy to understand that there are thousands of different cleaning products in the market, containing hundreds of components representing different levels of hazard.

Some of these products include harmful substances. Almost all of the cleaning products are either irritating or corrosive. Many of them also contain substances that can cause skin problems and allergies. Possible adverse health effects include burns; irritation of ear, nose and throat; damage to the central nervous system, kidneys, liver, lungs, and the reproductive system. Infections and needlestick injuries are also common in some settings. Additionally, some products cause serious damage to the environment (e.g., sodium hypochlorite, alkyl phenols, etc.).

However, less attention has been paid to the health and safety of this particular group of workers, and the situation is complicated further where cleaning services are subcontracted, so that the cleaners are not directly employed by the organisation(s) at whose premises they are working.

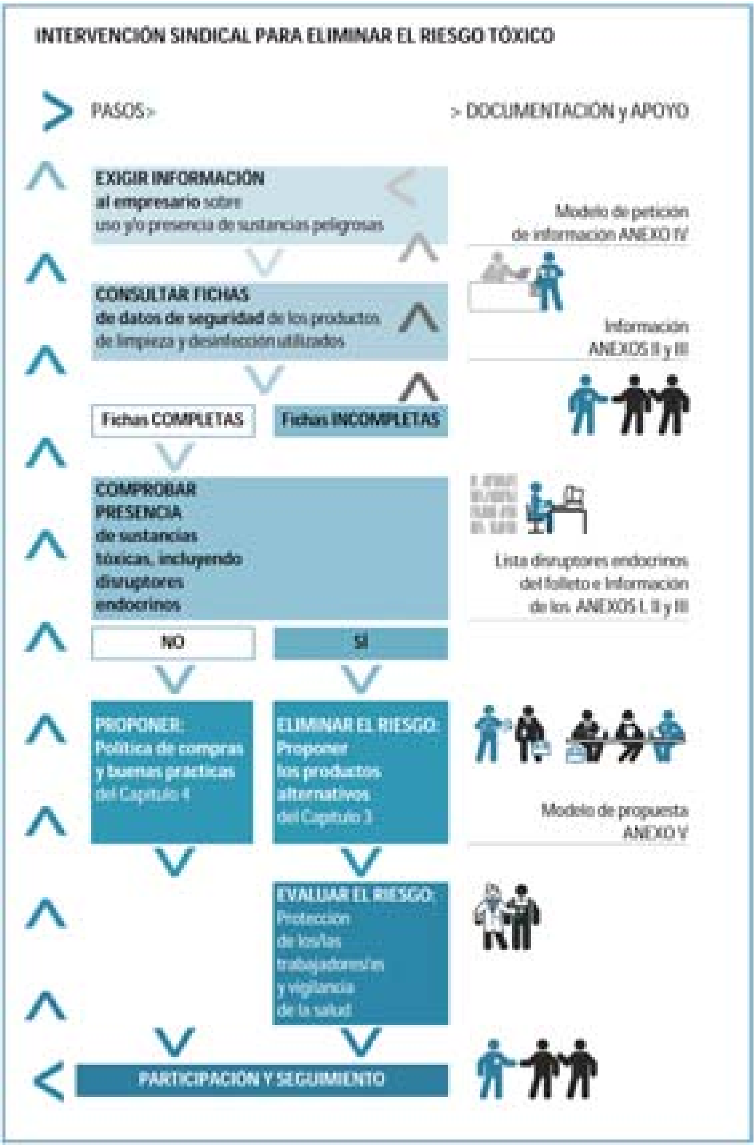
Solution

Given the lack of training in risk prevention, it was decided to implement a specific training and educational programme for representatives of workers in the cleaning sector. This initiative had two major goals: first, to facilitate their involvement in the prevention of risks caused by chemical substances within their working environment. Second, to assist them in applying the practical knowledge acquired during the training to influence the improvement of health and safety at their workplace. The overall aim was to raise awareness and provide information about risks involved in the handling of chemical substances.

The training programmed was developed in collaboration with the Regional Secretariat of Environment and Occupational Health of Comisiones Obreras in the region of Aragón, and was specifically designed for workers' 'prevention delegates'. Over 1,000 delegates took part in the training covering cleaning staff in banks, hospitals, factories, local government buildings and private dwellings. The enterprises were selected with the aim of obtaining wider dissemination of the information, from participants to delegates in other companies, thus reaching a large number of workers. Women were specifically targeted for the training programme. The delegates were employed by the following companies:

Company	Activity	Nº of workers
Tiebel Sociedad Cooperativa	Cleaning of offices, factory premises, private residences, etc.	30
Limpiezas Laurbe	Cleaning of bank offices belonging to Ibercaja	250
Valymsa S.A.	Cleaning of Hospital Clínico Universitario	192
CCP	Cleaning of buildings and public centres belonging to Zaragoza's Town Hall	300
Maconsi	Cleaning of Hospital Miguel Servet	300

Some of the difficult working conditions in the sector affected the participants: many suffered frequent changes of enterprises and subcontracts throughout the course, or found it impossible to participate because of their workload. With only one exception, delegates received basic risk prevention training provided by the trade union, as well as a 20-hour course provided by their company. However, they had little knowledge about: risk assessment or how to interpret information about chemical risks; tools to identify the chemical



substances present at their working environment; good practices to reduce risk; or criteria to select less dangerous products.

The training course covered:

- obtaining and analysing information from labels of safety data sheets;
- risk prevention tools, including making proposals for substituting with lower risk products;
- information about how products work and cleaning processes;

- presenting proposals to employers.

The training programme aimed to help the participants learn from their own experience, while trainers performed a guiding function as facilitators. The work was carried out in groups, at times and dates agreed by all in order to facilitate attendance. Six group-working sessions were held combined with one assessment or personalised tutorial session. The sessions were organised in a logical sequence, starting from general subjects such as regulations and risks prevention, to more specific issues such as information about chemical products and risks, disinfection processes, components and selection criteria of disinfecting products or good practices in disinfection.

A crucial aspect of the training process is the transfer of knowledge from the learning environment to the workplace. The aim was that theoretical knowledge was immediately applied at the enterprise throughout the course. Each delegate carried out initiatives at her own enterprise. Starting from a brief presentation made by the trainer, the delegates used their enterprises' data and experience to assess the risks that the cleaning products they used could pose for health and the environment. Group work allowed delegates to learn about practices and experiences in other enterprises. Using this information, they considered the different strategies for intervention and planned the best alternative for their particular case. In the following session the results were analysed by the group.

Results

Following the course, the participants were able to apply their knowledge to the workplace in a variety of ways, including discussing issues with employers and informing other workers of risks and the proposals to prevent them. They learned how to ask the enterprise for information about risks caused by dangerous substances, and how to obtain the labels and safety data sheets of the products and analyse them. Delegates in two-thirds of the companies presented a proposal to the management for the substitution of dangerous products with lower risk alternatives.

With support from AMAT (*Asociación de Mutuas de Accidentes de Trabajo y Enfermedades Profesionales de la Seguridad Social* - the association of social security work accident and occupational disease insurance organisations), ISTAS has edited the information and experience collected in this programme into a guide for prevention delegates entitled *Guide for the elimination of toxic substances in the cleaning sector*. It has also organised an educational conference aimed at prevention delegates in the cleaning sector from all over Spain, with continuity during 2003.

The programme has resulted in various benefits.

- The financial cost of the training activity was not high, while the benefits in terms of not only awareness raising, but also short- and long-term prevention are good. The number of immediate interventions generated after the program was high.

- Benefits generated by the substitution, elimination or control of dangerous substances, are both health and environmental protection improvements.
- Delegates developed a better image of their job and greater confidence to speak with, negotiate and present proposals to their employers.

Comments

This case covers a sector that is not usually the focus of attention, despite employing a high number of workers. The participatory approach described here, with its emphasis on the practical application of knowledge, may help in a sector where it is often difficult to ensure that the necessary information reaches the mobile workers.

2.25 MANAGING HAZARDOUS WASTE FROM UNIVERSITY LABORATORIES

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Issue

University laboratories handle a large number of substances, and the different operations performed on them generate waste that is often hazardous for human health and the environment.

Problem

There are research and teaching laboratories in the various centres of the University of Córdoba. In the laboratories a large variety of dangerous substances are continually being handled, leading to the production of hazardous waste.

Although the volume of hazardous substances used is also usually much lower than in the industrial sector, the situation is complicated in some important respects.

Variety: risks can have very different causes and consequences depending on the existing installations and the operations performed in them. Conditions may frequently change, with different experiments being carried out for different projects.

Intensity: it is common to work with products of very high toxicity, and very intense short-term exposure can occur.

Multiplicity of risks: a high number of chemical products and biological agents of very diverse characteristics are usually present.

Degree of experience and skills: although laboratory technicians have high professional qualifications, the presence of inexperienced students undergoing practical training in specific laboratory activities is frequent.

The university was also concerned that waste was not properly managed and that they were not complying with legal requirements. The main risks identified related to:

Handling and transfer: Improper handling of waste leads to different risks depending on its characteristics. For example, the risks with chemical waste included leakage, splashing, skin contact, inhalation or ingestion. They have different health consequences, ranging from immediate effects (skin damage, irritation, etc.) to long-term serious harm (carcinogenic, mutagenic, teratogenic, etc.). Biological agents in laboratories where microorganisms or infected animals are handled may lead to infection risks. Improper handling of physical waste (e.g., glass, waste liable to emit ionising radiation) can cause harm of varying severity if not stored and treated properly.
Packaging: unsuitable containers lead to increased risks of leakage and contact. Ignorance of which waste products should not be mixed in a single container can give rise to chemical reactions with potentially dangerous consequences.
Labelling: insufficient or inappropriate labelling means that no warning is given of the specific risks of a product or waste, or of the precautions to be taken. The label is the first source of information for protection.
Storage: the most common problem in university laboratories is the storage of incompatible substances close to each other. This can cause accidents of various kinds, as well as increasing the risk of leakage.
Training: users' lack of training and information further increased the risk both for their health and the environment.

Solution

To tackle the broad range of problems identified, an 'integrated system of control and removal of hazardous waste' was established for the control, treatment and disposal of laboratory waste. The steps included in this integrated system were as follows.

1. Initial study to find out the producers, types and approximate quantities of hazardous waste produced in the different areas.
2. Inclusion of the university in the official Register as a small producer of hazardous waste (production of less than 10,000 tons under the Waste Act 10/98).
3. Establish contact with an authorised manager of hazardous waste.
4. Preparation of temporary stores in the different production centres.
5. Contact with a supplier of approved, high-density polyethylene containers, resistant to the majority of chemical products.
6. Design and implementation of the SEPA web page as a dissemination point for all the information on the subject in the university.
7. Preparation of a written procedure for the control and removal of hazardous waste, including all the relevant forms to be downloaded and completed.

8. Communicate the creation of this service to all producers of hazardous laboratory waste in the university by means of visits, letters and via the SEPA web page.
9. Initiate the weekly removal of hazardous waste.

The waste collected from the various laboratories is taken to a temporary store. Once there, it is classified according to its properties and incompatibilities and remains there for a maximum period of six months until being collected by the authorised waste manager. All of the necessary control documentation is processed (e.g., acceptance document, notification prior to the transfer and control, monitoring document), so that an annual declaration can be presented to the Board of Environment each year.

Following the introduction of this system, a new facility for temporary storage was built in the university campus of Rabanales. A risk assessment was conducted prior to the design of the building in order to identify any potential hazards in the store. This assessment considered the types of tasks and operations that would be carried out, with an estimation of the level, probability and severity of the associated risks. As described above, one of the major sources of risk was the variety of hazardous materials being stored. Therefore, the store was designed with six separate modules to house groups of compatible waste: solids, liquids, acids, solutions, oils and bio-sanitary, and flammables.

Each of the modules has an airtight collector box to collect the waste in the event of leakage. The building has natural and forced ventilation by means of two air extractors. The module for flammables is separate from the rest and has specific safety measures, such as fireproof electrical installation, floor covered with resins suitable for the materials to be stored, separate smoke detector, and its own localised extraction system which is activated in the event of detecting gases in the air.

The store has also been equipped with safety and emergency facilities: safety shower, eyewash, neutralisers, first aid kit, CO2 extinguisher for fires in the electrical installation, and ABC multi-purpose powder extinguisher for fires caused by the products being stored.

The store workers have been provided with personal protection equipment that is necessary for the tasks they perform and for cases of emergency. The store also has all the necessary safety signs.

Interior of the main area of the storage facility. On the left are the different storage modules. N.B.: there is both forced ventilation installation (top centre) and natural ventilation (bottom right)

Finally, the above initiatives have been combined with training for laboratory technicians. It includes both general risk prevention modules, and others specific for some staff (biology laboratory; chemistry laboratory; radiological protection, etc.).

Results

Between 2001 and 2003, the number of university units within the waste disposal scheme more than doubled. As well as achieving improvements in work and environmental safety, the scheme has had a positive impact on safety and environmental awareness and education at the university.

Comments

The importance of having systematic procedures for laboratories waste control in universities and other educational and training establishments is not always fully appreciated.

From left to right: first-aid kit, eye wash, showers, sink and hand drier, CO^2 extinguisher and alarm

2.26 ELIMINATING ISOCYANATES DURING HOT WORK ON POLYURETHANE

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Information about the extractor device and training materials *Your Job. Your Body. Your Life! In automotive industry* are available in English at www.jklsupport.nu
An English summary of the studies that led to the solutions (IVL rapport B1501 Effektiva åtgärder mot exponering för isocyanater på bilverkstäder) is available at www.ivl.se

Issue

Car bodywork repairs. Measures for eliminating air contaminants containing isocyanates in connection with thermal fragmentation of polyurethane during MIG welding of automotive sheet and cross-grinding of automotive sheet with polyurethane lacquer**.**

Problem

Heating polyurethane (PUR)-coated material to temperatures above 150 °C can give rise to atmospheric by-products containing monoisocyanates (methyl isocyanates - MIC, isocyanic acid - ICA, etc.) and di-isocyanates. Isocyanates are highly reactive. A major concern is asthma. Methyl isocyanate, for example, is a strong irritant and sensitiser. It irritates the eyes, skin, mucous membranes, throat, lungs etc. Health problems can result from a single over-exposure or from long-term low level exposure.

Integrated extractor fitted to MIG welding gun

One area in which the problem occurs is that of MIG-welding and cross-grinding of automotive sheet in connection with car bodywork repairs. The heating causes thermal degradation in which monomeric isocyanates are reformed.

Solution

A project group consisting of the social partners, business undertakings and affected employees, the Swedish Work Environment Authority and occupational hygiene specialists was formed to ascertain where these problems where greatest.

The group's remit was to investigate where the problems existed and to find and test practical solutions. The studies of air contaminants formed in connection with the heating of PUR-coated materials showed that the main problem area was related to MIG welding and cross-grinding operations giving rise to spark formation. The commonly used safety measures, such as separate process ventilation, were not sufficient to prevent the risk of contaminant dispersion. They therefore devised a number of equipment modifications to prevent exposure to air contaminants containing isocyanates, backed up by information and training.

MIG welding solution

The MIG welding device was fitted with a special nozzle (integrated extraction device) that extracts the welding fumes directly at the welding point, the source of the fumes. To function correctly, the extraction device has to be balanced so that the gas shield used will not be affected. Following instruction and training, an experienced welder can achieve this in 20 minutes, and it only needs to be done once.

Grinder cross-cutting solution

The grinder was fitted with a wheel guard that is integrated with an extraction unit. Once again, the contaminants formed are trapped at source.

Before: cross-grinding without the integrated extractor device

After: cross-grinding with the integrated extractor device

Training

In order for the solutions to be accepted and properly applied, thorough information and training is needed concerning the limitations of ordinary process ventilation and why the solutions should be applied and how they must be used. Therefore specific training materials were developed.

Information measures were also taken to explain which materials can cause problems and what steps are to be taken beforehand to avoid and reduce risks, for example, removal of polyurethane before welding, cleaning or the use of non-heat generating methods (e.g. sawing, drilling etc.).

Results

Use of an integrated extractor device on the equipment in service produced an improvement that effectively controlled emissions.

Fitting of an integral extractor device costs about EUR 670 in the case of a MIG welding unit and about EUR 90 for a cross-grinder. Since these measures remove the air contaminants, they avoid the need for alternative anti-diffusion measures such as rebuilding workstations and insulating them from each other, which implies a potential saving of about EUR 5,500 to EUR 17,000 per workstation.

Comments

Measures involving elimination of emissions at the source (such as suction devices integrated into equipment) can result in considerable cost savings regarding ventilation or exhaust equipment. It is however important to include training in a solution that introduces new equipment and work procedures.

2.27 HOSPITAL EQUIPMENT STERILISING: GLUTARALDEHYDE SUBSTITUTION

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Essex Rivers Healthcare NHS Trust

Issue

Eliminating staff exposure to a strong sterilising agent, while achieving fast and safe surgical equipment sterilisation, in a hospital day surgery unit.

Problem

Glutaraldehyde is a sterilising agent that has been used for delicate surgical instruments such as flexible endoscopes, which cannot be sterilised by heat treatment, for example. But it is a powerful irritant and respiratory sensitiser. In the day surgery unit, some staff had become sensitised to the fumes, giving them respiratory problems, others complained of headaches and lethargy and some suffered discolouring of the skin from contact with the solution. It was found that during certain operations (refilling and breakdown) the legal maximum exposure level was being exceeded, so the hospital had to review its endoscope cleaning processes. However, for patient safety in day surgery, where instruments have to be ready for reuse quickly, an effective and fast sterilising system is essential.

Solution

The NHS Trust formed a committee to evaluate the options available to them. The committee comprised of four endoscope consultants, the directorate manager, the day services manager, the endoscope room supervisor, the trust microbiologist, the local safety representative and the trust risk manager. The committee considered two options:

a) improve the local exhaust ventilation in the endoscopy room to a standard capable of ensuring that the maximum legal exposure limit was not exceeded;

b) substitute glutaraldehyde with a safer disinfectant.

The committee took advice from engineers before deciding that the first option could not guarantee that exposure levels would not exceed allowable exposure limits in 'breakdown' situations. To investigate the second option, a number of manufacturers of cleaning substances were invited to give presentations to the committee. Four of the five companies were promoting chemical substances containing peracetic acid, while the other one used an oxidised saline solution, the principal active ingredient being hypochlorous acid. The committee considered all aspects from effectiveness as a disinfectant to installation costs, from wear and tear on equipment to health and safety concerns.

The oxidised saline solution system (Sterilox) performed well in most areas. On the plus side the substance provided effective and fast disinfection, whilst having limited health and safety or environmental risks. On the down side the system was expensive to install and the lacquer coating on the existing endoscopes was not compatible with the saline solution. In addition, the manufacturer of the endoscopes used in the hospital, refused to guarantee their equipment if Sterilox was used on it. The committee then invited several other endoscope suppliers to test their equipment with the substitute and one company supplying 'Fujinon' equipment provided the necessary guarantees.

After exploring and weighing up the options, the committee advised the hospital management board that the health and safety concerns should be the priority and that the oxidised saline solution was preferred, despite being the most expensive option. The board accepted the committee's advice and the new system was installed. Initially just the older endoscopes were replaced, but within three years, only endoscopes compatible with the new disinfectant were used in the day surgery unit.

Following the introduction, the effectiveness of the system was monitored for both effectiveness of disinfection and staff safety.

Results

The hospital believes that the new disinfectant offers a safer level of quick (10 minutes) sterilisation than glutaraldehyde. It appears that both patient and staff safety have been improved. In addition, although initially the new system was expensive to install, the new endoscopes that had to be introduced were significantly cheaper than the old ones.

Comments

What appears to be an expensive option does not always turn out to be so. The safer solution, substitution, although initially appearing expensive has also had cost benefits for the hospital. Consultation and getting the right expertise is important.

A working group of both those concerned with staff safety and those concerned with patient safety was needed to find a solution to meet differing concerns, which finally resulted in benefits for both. Working closely with suppliers was also important.

Elsmtead day surgery unit

2.28 REMOVING ALCOHOL FROM LITHOGRAPHIC PRINTING

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Issue

Use of isopropanol (alcohol) in the fount solution within the dampening system of lithographic printing presses. The solution was to remove the use of isopropanol.

Problem

In conventional lithographic printing, the lithography printing plate (one for each colour) has water (dampening) applied with rollers, and ink applied simultaneously with other rollers. The water is attracted to the non-image areas (hydrophilic) of the plate and stays there due to the meniscus effect (surface tension) within microscopic pores in the surface. The ink is attracted to the image areas (oleophilic) that consist of a surface coating that is produced photographically. Each plate then shows areas that are damp (non image) or inked (image). Good lithography uses as little ink and water as possible to aid ink/water balance.

A thinner layer of water is achieved by adding a 'wetting' agent in the form of alcohol (isopropanol), which is a volatile organic compound. An acidic water additive (fount solution) is used to ensure that the plate background remains water attracting (hydrophilic).

Exposure to isopropanol can produce both short-term and long-term health effects and is an irritant to the eyes and the respiratory system. It is also an environmental hazard.

KentArt Printers | design, print & fulfilment since 1934

Solution

It was decided to introduce 'alcohol-free' litho printing. The same basic principles of lithography apply but without the alcohol element. This involved making press modifications.

- The 'Pan' roller (polyurethane) and 'forme' damper needed to be of a different composition (25 deg' shore hardness and fine grained) to carry the water more efficiently.
- The roller settings had to be adjusted more accurately to give better control of water to the plate.
- A special fount solution was needed.

The company has also moved to use other more environmentally friendly products, including vegetable-based inks and an aqueous-based coater.

Results

There was an initial cost of EUR 4,085 for each press conversion to fit the special rollers, but the change has resulted in a saving of EUR 3,000 per year through not purchasing isopropanol.

The measures have led to a healthier work environment. There has been no sickness absence due to inhaling alcohol fumes and machine minders and factory staff do not report the symptoms that alcohol can give, such as headaches, drowsiness and nausea. Visiting printers have commented that the factory does not smell of alcohol and is a more pleasant working environment. In addition harmful emissions to the local environment have been reduced.

There is a feeling that the standards of printing have improved, because the equipment has to be kept in very good condition and be well maintained to run effectively.

Comments

Improved health and safety for workers can also mean improved environmental performance. The measures adopted were required and common practice in some countries, but not obligatory in the UK.

2.29 REDUCING AIRBORNE PARTICLES IN CLAY PREPARATION: BRICK MANUFACTURING

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Issue

An in-house technical modification to equipment to reduce airborne clay particles during the preparation of clay for brick manufacturing

Problem

Clay is fed on a continuous basis from external box feeders into the clay preparation plant. It is fed by conveyor belt into a large grinding mill (wet pan) where water is added. The clay falls into the wet pan from a height of approximately two metres. The clay is then crushed through grids that are located in the floor of the wet pan. The clay then undergoes a series of other processes before being shaped for the manufacture of bricks.

The hazard associated with the process of feeding the clay into the wet pan area is the creation of airborne particles as the clay drops from the conveyor. The clay preparation building is a large building and the airborne particles had the potential to disperse over a large area within the building.

The risks associated from this process were mainly to the three operators working within the area, and included acute health problems from inhalation and irritation that could lead to chronic health problems. The airborne particles also shorten the life span of machinery and can lead to safety incidents from increased maintenance.

Figure 1

Spray nozzle of atomising dust suppression unit

Figure 2

Spray nozzle of atomising dust suppression unit fully operational

Solution

The drop from the conveyor into the wet pan could not be reduced and enclosure was not possible. The problem was to find a sustainable solution that reduced and mitigated the concentration of particles within the air. Detailed analysis found that the drop height from the conveyor to the base of the wet pan was causing a plume of airborne particles.

The company's engineering department decided that suppression of the particles at source would be a more effective method than local exhaust ventilation, and that this could be achieved through a water-spraying device. The engineering department constructed a dust suppression unit (see figure 1) that produced an atomised spray at the ejection point of the conveyor. A fine water mist is produced which acts as a 'blanket' of moisture in the air over the wet pan so that airborne particles cannot disperse into the clay preparation building.

An eight-week trial period following the installation of the atomising water suppression unit included taking measurements of the airborne particles and comparing them with measurements prior to installation. It was found that the suppression unit effectively reduced the levels of airborne particles in the clay preparation building to well below the legal limit for respirable dust and crystalline silica.

The change was backed up with operator training which included:

- why the airborne particles had to be reduced. This was reinforced with the use of a video showing the effects of inhalation of dust;

- correct use of respiratory protective equipment by means of a 'tool box talk';
- correct cleaning methods;
- purchase of an alternative vacuum cleaner for easier access;
- training on how to operate and maintain the atomised spray unit to include daily checks.

Following the trial the unit was brought into full operation (see figure 2) and following its success, further areas were fitted with the same system.

Results

- A serious risk to worker health has been significantly reduced.
- The area is cleaner and so more pleasant to work in.
- Worker motivation has been improved, leading to improved efficiency in the plant.
- The units were manufactured in-house. The cost of the installation and manufacture was relatively small (720 euro).

Comments

Many improvements such as this one are simple and inexpensive. In-house resources are often available that can be utilised for solving health and safety problems.

3.

ANNEXES

ANNEX 1. SOURCES OF FURTHER INFORMATION

Further information on occupational safety and health and dangerous substances is available from the Agency's European week 2003 website http://osha.eu.int/ew2003/ where the full text of all Agency publications can be downloaded free of charge. Additional information on the elimination and substitution of dangerous substances is available through the Agency's website at: http://europe.osha.eu.int/good_practice/risks/ds/

Information on occupational exposure limits is available at: http://europe.osha.eu.int/good_practice/risks/ds/oel/

These sources are being continually updated.

AGENCY PUBLICATIONS

Reports

How to convey OSH information effectively: the case of the dangerous substance

Factsheets

Factsheets provide concise information on a range of issues and are available in all 11 official Community languages.

- Facts 33: *An introduction to dangerous substances in the workplace*
- Facts 34: *Elimination and substitution of dangerous substances*
- Facts 35: *Communicating information about dangerous substances*
- Facts 39: *Respiratory sensitisers*
- Facts 40: *Skin sensitisers*
- Facts 41: *Biological agents*

Magazine

Magazine 6: *Dangerous substances: handle with care*

Forum

Forum 9: *Hazardous substances in the workplace – minimising the risks*

Campaign material

European Week for Safety and Health at Work 2003

The Agency has produced an information pack consisting of posters, leaflets, factsheets and post cards to promote the week and its theme 'Dangerous substances – handle with care', available at http://osha.eu.int/ew2003/

Additional information on other Agency publications is available at the Agency website http://agency.osha.eu.int/publications/

ANNEX 2. OVERVIEW OF PRACTICAL EXAMPLES

COUNTRY	AWARD	TITLE	SECTOR/TASK	ISSUE	MAIN INTERVENTION
Austria 08	✓	Dust capture in metal grinding	Iron and steel component production	Grinding dust and welding smoke	Technical solutions, control of dust
Austria 06		Lock out – measures for maintenance	Mining, production of mineral materials	Maintenance	Lock-out system
Belgium 21	✓	Safety for chemistry students	Education - universities	Controlling risks to chemistry students	Risk assessment and control methodology
Belgium 23		Chemical risk prevention in school laboratories	Education - schools	Controlling risks to staff and pupils	Information and communication tools
Denmark 30	✓	Environmental assessment and chemical management	Galvanised steel and stone roofing production	Inadequate policy and procedures	Chemical management system
Denmark 31		Metal degreasing - from solvents to demineralised water	Metal component manufacture	Solvents	Substitution with demineralised water and low alkaline degreaser
Denmark 32		Chemical safety on merchant sea vessels	Maritime	Poor management, lack of specific information	Sector-based electronic resources: management and product information support
Finland 01	✓	24-hour safety - a cooperative approach between social partners	Chemical industry	Reaching companies	A cooperation network
Finland 02	✓	Training in safe and environmentally-friendly use of chemicals	Various SMEs	Practical support for SMEs	Risk assessment support scheme
France 12	✓	Chemical products 'use/sector' matrix	Various SMEs	Sector specific product information	Electronic database
France 13		Labelling raw materials	Plastics and rubber	Ensuring safety information	Labelling system
Germany 03	✓	GISBAU – an information system for SMEs	Construction/building SMEs	Providing relevant sector information	Product database and risk assessment system
Germany 04		Electronic risk prevention tool	SME craft trades -painters and varnishers	Practical support for SMEs	Electronic tool and practical support
Germany 05		Bitumen Forum	Road laying	Emissions from bitumen	Cooperation forum and 'reduced temperature' asphalt laying
Greece 18		An automatic lubrication system for the extrusion chamber of brass billets	Metal working - extrusion of brass billets	Talcum powder lubricant	Automation and substitution with boron nitride
Greece 19		Galvanising - modified degreasing process	Galvanising steel constructions	Fumes from degreasing	Substitution, including biological degreasing, technical changes
Ireland 16	✓	Eliminating methylene chloride from bitumen binder testing	Asphalt-coated road materials manufacture	Use of methylene chloride during product testing	Subsitution with a heat-testing system, also fume cupboards etc.
Ireland 17		Reducing ethylene oxide exposure during sterilisation	Medical device manufacture	Sterilisation with ethylene oxide	Engineering controls
Italy 10	✓	Preventing exposures in vehicle repair	Vehicle bodywork and repair	Paint, engine oil, putty, dust etc.	Water-based paints, technical and work environment measures

ANNEX 2. OVERVIEW OF PRACTICAL EXAMPLES

COUNTRY	AWARD	TITLE	SECTOR/TASK	ISSUE	MAIN INTERVENTION
Italy 11		Elimination of N-N dimethylacetamide	Silicon chip semiconductor manufacture	Washing, rinsing	Substitution with oxalic acid
Netherlands27	✓	Reducing dermatitis among hairdressers	Hairdressing	Exposure to skin allergens	Voluntary industry agreement, resources and campaign
Netherlands29		Automated management system	Vehicle crash repair	Solvents, welding fumes, sanding dust etc.	Trade association electronic databank and resources
Portugal 36		Reducing risks from glue vapours	Production of isothermal boxes	Styrene and acetone vapours	Substitution of styrene by using polyurethane glue, technical changes
Spain 34	✓	Training cleaners to prevent chemical risks	Cleaning services	Cleaning chemicals, wastes etc.	Training in risk assessment and prevention
Spain 33		Managing hazardous waste from university laboratories	Education - universities	Laboratory waste handling and disposal	Management system, storage facilities
Sweden 14		Eliminating isocyanates during hot work on polyurethane	Car bodywork repairs	Air contaminants containing isocyanates	Extraction devices fitted to welding and grinding equipment
UK 25	✓	Hospital equipment sterilising	Healthcare - endoscopy	Eliminating staff exposure, maintaining effective sterilisation	Substitution of glutaraldehyde
UK 24		Removing alcohol from lithographic printing	Printing	Use of isopropanol	Substitution and technical changes
UK 26		Reducing airborne particules in clay preparation	Brick manufacturing	Airborne clay particules	Equipment modification

European Agency for Safety and Health at Work

Dangerous substances handle with care

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