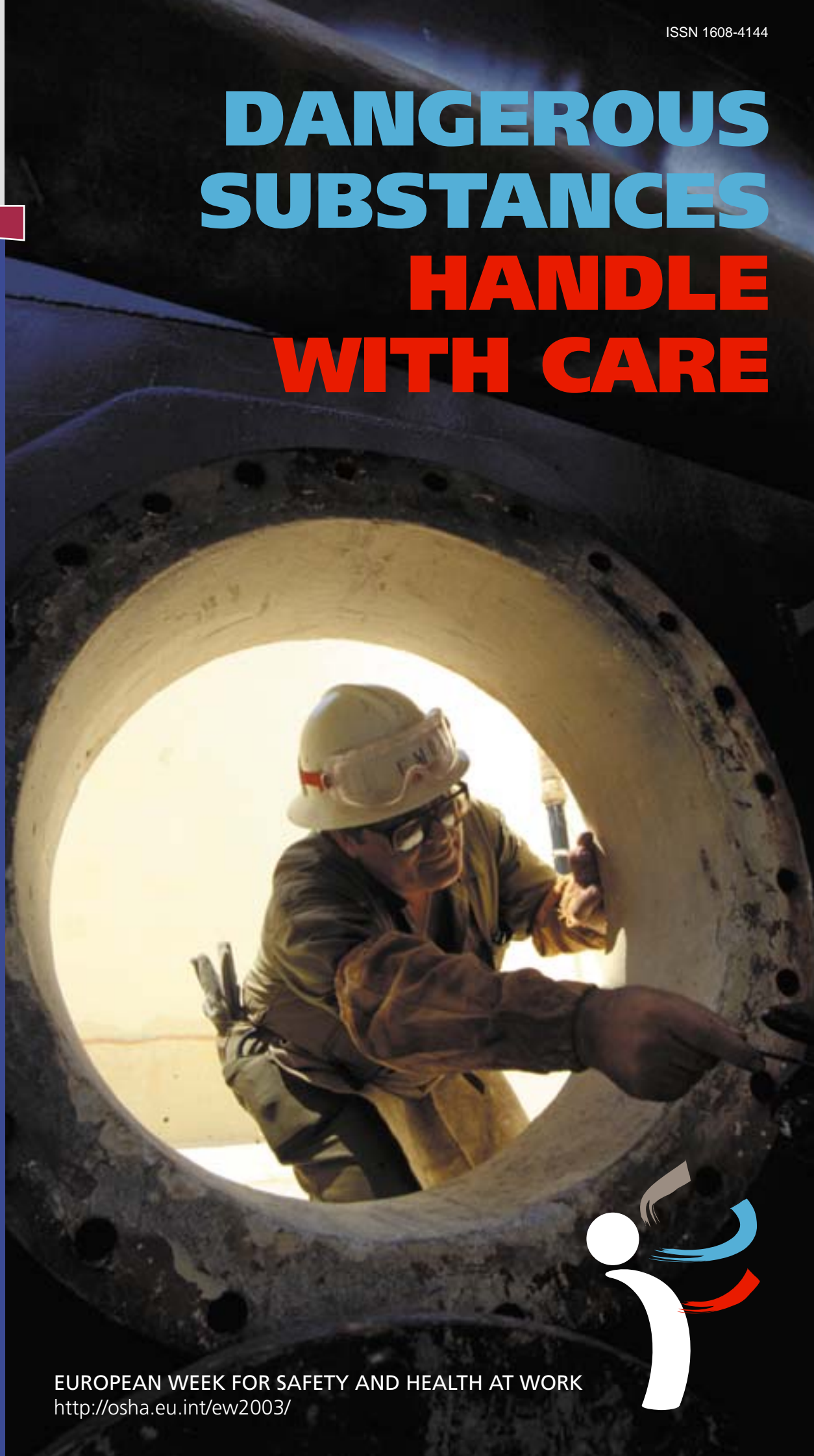


# DANGEROUS SUBSTANCES HANDLE WITH CARE

6

Magazine of the European Agency for Safety and Health at Work

magazine



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Luxembourg: Office for Official Publications of the European Communities, 2003

ISSN 1608-4144

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## HANS-HORST KONKOLEWSKY

Director, European Agency for Safety and Health at Work



# Foreword

**D**angerous substances are present in most workplaces. Asbestos in buildings, solvents in metalworking, diesel exhaust fumes in garages, and viral hepatitis in hospitals all present a wide variety of threats to human health.

The European Union is committed to reducing the risk to workers from dangerous substances. Action is under way at all levels, from the REACH programme to assess the risks of substances before they are marketed, through the agreement of common exposure limits, to the provision of 'good practice' information for workers and employers.

Because of the enormous scope of the topic, statistics on dangerous substances are hard to come across, but we do know that:

- about 32 million workers in the EU — almost a quarter of those employed — are exposed to cancer-causing agents <sup>(1)</sup>;
- 22 % of workers report that they are breathing in fumes and vapours at work for at least a quarter of their working time <sup>(2)</sup>;

<sup>(1)</sup> *Occupational exposure to carcinogens in the European Union 1990–93*, Carex, International information system on occupational exposure to carcinogens, Finnish Institute of Occupational Health, Helsinki 1998.

<sup>(2)</sup> Paoli P. and Merllie D. (2001), *Third European survey on working conditions 2000*, European Foundation for the Improvement of Living and Working Conditions.

- 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 illnesses <sup>(3)</sup>.

To address these risks, the Agency is organising a Europe-wide campaign in cooperation with the Greek and Italian Presidencies and the other Member States as well as all candidate countries and the EFTA countries to raise awareness about this complex but vital topic. European Week 2003 takes place in October, but events are being carried out throughout the year. The slogan for the week is 'Dangerous substances — Handle with care'.

The Agency is working in several areas in order to address the challenges posed by dangerous substances. Much of this activity can be found on the Agency's web site at: <http://osha.eu.int/ew2003> dedicated to European Week. Key aspects include the dissemination of research on dangerous substances in order to enhance understanding of the issues faced and providing practical information to those in the workplace, allowing them to take action to reduce risks.

To provide the right information on key safety and health topics to our different stakeholders is a main priority of the Agency. For researchers, dangerous substances information includes a web page with links to documents used in the decision-making process for setting exposure limits. For workers and employers, the Agency provides 'good practice' information, including information on the substitution of organic solvents and asbestos. Political decision-makers and social partners can find information about interesting prevention strategies and programmes in the Member States. The web site also offers information from the EU and around the world on a wide range of related information including a special web feature on occupational exposure limits. In addition, the Agency provides a forum where it is possible to put questions in any EU language to the global net community.

This magazine brings together articles by policy makers, social partners and experts to give a wide perspective on the theme of dangerous substances. It is hoped that these articles will provide you with an interesting picture of the scope of the topic and an update of initiatives taken to reduce the risks to workers.



<sup>(3)</sup> 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>

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## BERTIL REMAEUS

Chair, Administrative Board of the European Agency for Safety and Health at Work

# A view from the Board

## A multifaceted Europe-wide programme to combat a major workplace hazard

The European Agency for Safety and Health at Work has chosen dangerous substances, both chemical and biological agents, as the theme for European Week 2003. This subject area is both challenging and exciting as new risks, such as genetically modified organisms, combine with traditional hazards such as asbestos, present a large and complex topic.

The challenge facing the Agency in 2003 and beyond is to present this complex subject matter in a way that is comprehensible for all those who need information, whether worker, manager, occupational safety and health professional, researcher or policy-maker.

## The challenge of 'traditional' hazards

With the influx of new issues into occupational safety and health, it is easy to forget that we have not solved all the 'traditional' problems. Perhaps the greatest problem we face is that we do not know how many people are suffering from exposure to dangerous substances. Statistics on the effects of such exposure are limited. We may know about the horrendous consequences of asbestos exposure, but there are many other substances, such as organic solvents, where the full picture is not known.

## The impact of the changing world of work

One of the new challenges facing Europe today is the fact that a growing number of young people are entering working life with asthma, allergy or hypersensitivity problems. These persons may not be adequately protected by existing preventive measures.

Another issue is that the changing structure of working life leads to situations where the employee no longer is fully familiar with the circumstances at the specific worksite. Maintenance for example, traditionally an in-house activity, is now outsourced in many cases. This means that staff are entering a new and unfamiliar environment every time they carry out a job.

## Risk assessment — an essential

A risk assessment, complying with the European Union's framework directive<sup>(\*)</sup> and any additional requirements of national regulations, is an essential tool for employers. However, to be comprehensive, this assessment calls for detailed information on the hazards presented by the dangerous substance and the exposure patterns of the workers. This information is not always available and there is a need to improve the transmission of information down the product supply line from manufacturer to end-user. Data sheets accompanying the products are essential for the end-user but, in this case, pose a challenge for the manufacturer. How do you combine data on scientific and technical

matters with a realistic level of information understandable to the end-user? In my opinion, we have a long way to go to find an acceptable solution to this problem.

## Occupational exposure limits

Occupational exposure limits (OELs) are an essential tool in the control of exposure to dangerous substances. Unfortunately, the resources available for issuing scientific updated bases for limit values are too limited, leading to a situation where limit values are either missing or too old. Other problems with exposure limits include the challenge of dealing with mixed exposures, of which welding fume is a good example.

Even if we had better resources for issuing limit values, that would not be enough. The background and other relevant information must be communicated to those who are responsible and to those potentially exposed. This means that the information must be tailored in such a way that it is communicable with the employer of a small company, as well as with the younger generation setting out in working life.

## Exchanging knowledge

In an enlarged European Union, it is vital that we try to avoid inventing the wheel again. The knowledge and experience of many Member States must be disseminated to the new members, a situation where manufacturers and suppliers play a central role in keeping the standard at an acceptable level.

We must also try to foresee new problems when technologies change. Even if we use the same product as before, the consequences of new methods must be considered in advance. The example of low-molecule isocyanates is such a lesson. If the fact that heating polyurethane creates isocyanates had been foreseen, unexpected exposure could have been prevented, in a much better way than it actually was.

More understanding is needed not only of the products as such, but also of what kind and level of exposure is created when the employee is using or treating these products. Monitoring of exposure is not done extensively enough today. In a longer perspective, it is essential and, if we can get better information on the exposure pattern and make that information available to industry at large, it will also save money.

## Conclusion

The European Agency for Safety and Health at Work is facing the challenges described above. With its network-based organisation and use of the Internet, it seeks to communicate good practices and share research information to reduce the risks to workers from dangerous substances.

Good information and practices do exist throughout the European Union, whether in the form of guides on risk assessment for small and medium-sized enterprises in the United Kingdom, procurement methods in the Netherlands, practical guides in Italy, or accessible exposure limit information in Germany. The Agency seeks to share this information with all stakeholders in the European OSH community and, by so doing, reduce the risk to workers from dangerous substances.

<sup>(\*)</sup> Council Directive 89/391/EEC contains the basic provisions for health and safety at work where not covered by more specific legislation.



## BERNHARD JANSEN

Director, Directorate D — Adaptability, Social Dialogue and Social Rights, Employment and Social Affairs DG, European Commission

# Consolidating a culture of risk prevention

**The European Commission's view. The new European Community strategy on health and safety at work.**

### How important is the issue of dangerous chemicals in occupational safety and health?

Chemicals offer benefits that are indispensable to modern society, for example in food production, medicines, textiles and cars. They also make a vital contribution to the economic and social wellbeing of our citizens in terms of trade and employment.

The global production of chemicals has increased from 1 million tonnes in 1930 to 400 million tonnes today. We have about 100 000 different substances currently registered in the EU market, and the European Union's chemical industry is the largest in the world. In 1998, world chemical production was estimated at EUR 1 244 billion, of which 31 % was contributed by the EU chemical industry, which generated a trade surplus of EUR 41 billion <sup>(6)</sup>.

The chemical industry is also Europe's third largest manufacturing industry. It employs 1.7 million people directly and up to 3 million jobs are dependent on it. As well as several leading multinationals, it also comprises around 36 000 SMEs. These SMEs represent 96 % of the total number of enterprises and account for 28 % of chemical production.

Exposure to dangerous chemicals occurs at many workplaces outside the chemical industry. There are many occupations that handle a variety of chemicals as part of their work activities: for example, agricultural workers use pesticides, detergents and microbiological dusts, and construction workers commonly use solvents and paints.

According to the *Third European survey on working conditions 2000* <sup>(6)</sup>, 22 % of employees breathe in vapours, fumes, dust or dangerous substances during one quarter of their working time or more. In addition, 16 % of employees in the European Union handle or are in contact with dangerous products or substances for one quarter of their working time or more. Apprentices and blue-collar workers are significantly more exposed to dangerous substances. Regarding occupational groups, craft workers, machine operators and agricultural workers show the highest rate of exposure.

Exposure to dangerous chemicals can have acute and chronic effects on workers' health. Nowadays, acute poisoning by dangerous substances is not a major problem in most workplaces, but many workers are exposed to a combination of low-dose substances that interact with other occupational risks such as noise, vibration, radiation and psychosocial factors. Moreover, risks outside the workplace may have an additive or synergistic effect on occupational risks.



INSHT, Instituto Nacional de Seguridad e Higiene en el Trabajo, Spain.

### What do you see as the role of the Commission in the prevention of exposure of workers to harm from dangerous substances in the workplace?

Since the 1980s, the Commission has proposed several directives to protect workers' health from dangerous substances that have been adopted by Council and Parliament. These are, among others, Council Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work <sup>(7)</sup>, Council Directive 90/394/EEC on the protection of workers from the risks

<sup>(6)</sup> Paoli P. and Merllie D. (2001), *Third European survey on working conditions 2000*, European Foundation for the Improvement of Living and Working Conditions.

<sup>(7)</sup> OJ L 131/11, 5.5.1998.

<sup>(8)</sup> COM(2001) 88 final.

related to exposure to carcinogens at work <sup>(8)</sup> and Parliament and Council Directive 2000/54/EC on the protection of workers from the risks related to exposure to biological agents at work <sup>(9)</sup>. Other directives deal with specific substances such as asbestos. The Commission has also adopted directives establishing a list of indicative occupational exposure limit values, such as Directive 2000/39/EC <sup>(10)</sup>.

The Commission's proposals for legislative texts are submitted to the tripartite Advisory Committee on Safety, Hygiene and Health Protection at Work (ACSHHW) for an opinion. The draft proposals take into account the scientific opinion of various bodies such as the Scientific Committee on Occupational Exposure Limits (SCOEL) and the International Agency for Research on Cancer (IARC).

Furthermore the Commission has the duty, under Article 211 of the Treaty, to act as a watchdog, in other words, to ensure legislation is implemented and enforced. In this respect, Member States submit reports to the Commission on the transposition of directives and the Commission may bring a Member State to the European Court of Justice if it considers that there is a faulty application of a directive.

### Who are the key players in preventing exposure of workers to harm from dangerous substances in the workplace?

The new Community strategy on safety and health at work 2002–06 highlights the importance of involving all players — the public authorities, the social partners, companies, workers, public and private insurers <sup>(11)</sup>. The obligations of employers in preventing exposure of workers to harm from dangerous substances in the workplace are established in Council Directive 98/24/EC (protection of the health and safety of workers from the risks related to chemical agents at work <sup>(12)</sup>), Council Directive 90/394/EEC (protection of workers from the risks related to exposure to carcinogens at work <sup>(13)</sup>) and Parliament and Council Directive 2000/54/EC (protection of workers from the risks related to exposure to biological agents at work <sup>(14)</sup>). These include risk assessment, the prevention of risks associated with dangerous substances, arrangements to deal with accidents, incidents and emergencies, and information and training for workers.

In addition, Council Directive 89/391/EEC <sup>(15)</sup> on the introduction of measures to encourage improvements in the safety and health of workers provides that employers shall consult workers and/or their representatives and allow them to take part in discussions on all questions relating to safety and health at work. This presupposes the right of workers and/or their representatives to make proposals and a balanced participation in accordance with national laws and/or practices. Moreover, workers' representatives must be given the opportunity to submit their observations during inspection visits by the competent authority.

### What are the types of chemical that cause the greatest concern now and which are likely to give concern in the future, and what action should be taken?

Carcinogens, mutagens and substances toxic to reproduction are of great concern because of the harm that they can cause to workers. In

<sup>(8)</sup> OJ L 196/1, 26.7.1990.

<sup>(9)</sup> OJ L 262/21, 17.10.2000.

<sup>(10)</sup> OJ L 142/47, 16.6.2000.

<sup>(11)</sup> COM(2002) 118 final, 11.3.2002.

<sup>(12)</sup> OJ L 131/11, 5.5.1998.

<sup>(13)</sup> OJ L 196/1, 26.7.1990.

the early 1990s, about 32 million workers in EU countries were exposed to occupational carcinogens. The most common exposures were environmental tobacco smoke, crystalline silica, diesel exhaust, radon, wood dust, and benzene <sup>(16)</sup>.



Central Labour Inspectorate, Ministry of Economics and Labour, Austria

Asthma-producing allergens such as isocyanates, flour dust, and dust from rubber latex gloves, are a growing concern as well. Allergens — most of them traceable to nickel, cobalt, chromium, rubber, colophony, epoxy resin or acrylate — can also cause contact dermatitis. Some additives and preservatives also increase the risk of contact allergy <sup>(17)</sup>.

Other chemical groups that cause concern are organic solvents, which have been linked to neuropsychiatric disorders <sup>(18)</sup>, endocrine disrupters and persistent organic pollutants <sup>(19)</sup>.

Council Directive 98/24/EC (protection of the health and safety of workers from the risks related to chemical agents at work <sup>(20)</sup>), Council Directive 90/394/EEC (protection of workers from the risks related to exposure to carcinogens at work <sup>(21)</sup>) and Parliament and Council Directive 2000/54/EC (protection of workers from the risks related to exposure to biological agents at work <sup>(22)</sup>) provide for different preventive and control strategies. These are assessment of the risks, substitution by a non- or less dangerous substance, reduction of the use of dangerous substances, reduction of exposure, information to the competent authorities, controlled access to risk areas, hygiene and individual protection, information, consultation and training of workers, health surveillance, record-keeping and establishment of limit values.

<sup>(14)</sup> OJ L 262/21, 17.10.2000.

<sup>(15)</sup> OJ L 183/1, 29.6.1989.

<sup>(16)</sup> Kogevinas M., Kauppinen T., Boffetta P. and Saracci R. (1998), *Estimation of the burden of occupational cancer in Europe*, Final Report, Study financed by 'Europe Against Cancer'. Contract SOC 96-200742 05F02.

<sup>(17)</sup> European Foundation for the Improvement of Living and Working Conditions (1996), 'Work-related allergies', *Euro review on research in health and safety at work*.

<sup>(18)</sup> European Foundation for the Improvement of Living and Working Conditions (1995), 'Organic solvents', *Euro review on research in health and safety at work*.

<sup>(19)</sup> Porta M., Zumeta E. (2002), 'Implementing the Stockholm Treaty on Persistent Organic Pollutants', *Occupational environmental medicine*; 59, pp. 651-653.

<sup>(20)</sup> OJ L 131/11, 5.5.1998.

<sup>(21)</sup> OJ L 196/1, 26.7.1990.

<sup>(22)</sup> OJ L 262/21, 17.10.2000.



Kooperationstelle Hamburg, Germany

### How effective is legislation at controlling the risk to workers from dangerous substances in the workplace?

When properly applied, legislation is very effective, but a multi-faceted strategy is essential to ensure proper implementation.

In this respect, the Commission in its communication entitled 'Adapting to change in work and society: a new Community strategy on health and safety at work 2002–06' <sup>(23)</sup>, has proposed consolidating a culture of risk prevention, through the combination of a variety of political instruments — legislation, the social dialogue,

progressive measures and best practices, corporate social responsibility and economic incentives — and the building of partnerships between all the players on the safety and health scene.

To facilitate the implementation of Council Directive 98/24/EC, on the protection of the health and safety of workers from the risks related to chemical agents at work, the Commission is preparing practical guidelines on risk assessment, risk prevention, specific protection, prevention measures and occupational exposure limit values and biological limit values.

### How can communication of the hazards and risks of dangerous substances be improved, by suppliers, by official bodies and in companies?

Member States may take the measures necessary to ensure that employers can obtain on request, preferably from the producer or supplier, all the information on hazardous chemical agents needed to perform the risk assessment.

The employer shall ensure that workers are provided with the risk assessment results, information on the hazardous chemical agents occurring in the workplace, training and information on appropriate precautions, and access to any safety data sheet provided by the supplier.

This information shall be provided in a manner appropriate to the findings of the risk assessment. This may vary from oral communication to individual instruction and training supported by information in writing, depending on the nature and degree of the risk revealed by the assessment. Moreover, information should be updated to take account of changing circumstances.



<sup>(23)</sup> COM(2002) 118 final, 11.3.2002.



## KYRIAKOULA ZIEGLER-SKYLAKAKIS

European Commission

# How the EU establishes exposure limits for chemicals

## The work of the Scientific Committee on Occupational Exposure Limits (SCOEL)

The European Union has consistently endeavoured to ensure a high level of safety and health protection against risks related to chemical agents at work. Several directives have been adopted to achieve this objective.

The first comprehensive framework for Community legislation on chemicals in the workplace was included in Council Directive 80/1107/EEC<sup>(24)</sup>, which set out measures for the control of risks due to chemical, physical and biological agents. It was amended in 1988 by the adoption of Directive 88/642/EEC<sup>(25)</sup> which focused on the mechanism for setting exposure limits for hazardous chemicals. This directive was repealed on 5 May 2001 with the adoption of Directive 98/24/EC<sup>(26)</sup>. Furthermore, Council Directive 90/394/EEC<sup>(27)</sup> on carcinogens at work defines ‘carcinogens’ in relation to the criteria set up within the framework of Council Directive 67/548/EEC<sup>(28)</sup> and contains a particular provision for limit values.

An independent scientific assessment of the latest available data is used by the Commission to determine the relationship between the health effects of hazardous chemical agents and the level of occupational exposure.

In 1990, at the request of the Council, the European Commission set up an informal group of scientists, known as the scientific expert group, to give advice on limit values. This initiative was followed by the Decision of 12 July 1995<sup>(29)</sup> which established a formal basis for work on the scientific evaluation of risk at the workplace and the development of harmonised occupational exposure limits (OELs). Known as the Scientific Committee on Occupational Exposure Limits (SCOEL), this comprises 21 members drawn from all Member States and reflects the full range of scientific expertise necessary to fulfil its mandate.

The Commission appoints these members after consulting the respective Member States, having regard to the need to cover all relevant aspects of the committee’s work. The term of office for SCOEL members is three years and their names are published in the *Official*

*Journal of the European Union*. Meetings of the committee normally take place four times a year and individuals with particular expertise in the subject under study are sometimes invited to participate.

The SCOEL comprises experts in chemistry, toxicology, epidemiology, occupational medicine and industrial hygiene and has general competence in setting OELs.

The major task of the SCOEL is described in Article 2 of the decision: ‘The committee shall in particular give advice on the setting of OELs based on scientific data and where appropriate shall propose values which may include: the eight-hour time weighted average (TWA); short-term/excursion limits (STEL); biological limits’.

The SCOEL makes recommendations to the Commission on ‘health-based’ OELs. An OEL of this type may be established in those cases where a review of the total available scientific database leads to the conclusion that it is possible to identify a clear threshold dose below which exposure to the chemical in question is not expected to lead to adverse effects.

The committee has examined and agreed on several key principles concerning the criteria for setting OELs to fulfil the requirements of European legislation, which were published in 1999<sup>(30)</sup>.

## The way the committee works

After evaluating all available data, the SCOEL proposes a recommendation for a limit value in the form of a short summary document. Once the summary document is agreed on, the Commission makes it public to the interested parties with a request for health-based scientific comments and eventually further data. After a ‘comments period’ of about six months, the committee reviews the document in the light of the comments received and adopts the final version, which is then published by the Commission. Once the Commission services have received recommendations from the committee, they are in a position to develop legal proposals for OELs.

These SCOEL recommendations for limit values provide the scientific basis for the exposure limits included in Community legislation. There are two types of occupational exposure limit values, indicative and binding, and biological limit values. For any chemical agent for which an indicative OEL value is established at Community level, Member States shall establish a national exposure limit value, taking into account the Community indicative limit value, determining its nature in accordance with national legislation and practice. For any chemical agent for which a binding OEL value is established at Community

<sup>(24)</sup> Council Directive 80/1107/EEC of 27 November 1980 on protection of workers from the risks related to exposure to chemical, physical and biological agents at work. OJ L 327, 3.12.1980, 8-13.

<sup>(25)</sup> Council Directive 88/642/EEC of 16 December 1988 amending Directive 80/1107/EEC of November 1980 on the protection of workers from risks related to exposure to chemical, physical, and biological agents at work, OJ L 356, 24.12.1988:74-8.

<sup>(26)</sup> Council Directive 98/24/EC of 7 April 1998 on the protection of health and safety of workers from the risks related to chemical agents at work, OJ L 131, 5.5.1998, 11-23.

<sup>(27)</sup> Council Directive 90/394/EEC of 28 June 1990 on the protection of workers from the risks related to exposure to carcinogens at work, OJ L 196, 26.7.1990, 1.

<sup>(28)</sup> Council Directive 67/548/EEC of 27 June 1967 on the approximation of the laws, regulations, and administrative provisions relating to the classification, packaging, and labelling of dangerous substances. OJ L 196, 16.8.1967, 1.

<sup>(29)</sup> Commission Decision of 12 July 1995 setting up a Scientific Committee on Occupational Exposure Limits to Chemical Agents. OJ L 188, 9.8.1995, 14-5.

<sup>(30)</sup> Methodology for the derivation of occupational exposure limits: Key documentation, Scientific Committee Group on Occupational Exposure Limits; Employment and Social Affairs; European Commission; Employment, Industrial Relations and Social Affairs DG; Unit V/F.5 (1999).

level, Member States shall establish a corresponding national binding OEL value which can be stricter, but cannot exceed the Community limit value.

It was soon recognised that a procedure for the adoption of OELs generally acceptable to all interested groups would be of great importance and would facilitate the work of the Commission. For this reason in 1994, after extensive consultation of the tripartite Advisory Committee for Safety, Hygiene, and Health Protection at Work (ACSHH), the Commission approved a guidance note (an internal working document) on procedures to set limit values. It indicates the procedure to be followed and how, and at what stage, interested parties — government, industry, workers, the scientific community and other relevant organisations — may contribute to this procedure.

The stages leading to the establishment of OELs are:

1. the evaluation of the scientific data;
2. a recommendation from the SCOEL to the Commission services for a science-based OEL;
3. the development of a proposal for an OEL by the Commission services;
4. consultation with the Advisory Committee for Safety, Hygiene and Health Protection at Work; and
5. the adoption of the implementing directive.

To date the SCOEL has prepared summary documents on recommendations for OELs for about 109 chemicals. The majority of these documents (61) have been finalised and published and there are some 20 documents that will be finalised during 2003. The remainder are under discussion <sup>(31)</sup>.

Exposure limits for dangerous substances in a working environment play a major part in the control of occupational diseases. Currently the SCOEL is engaged in evaluating the toxic effects of crystalline silica and wood dusts which, according to Eurostat statistics, are the main cause of a great number of work-related fatalities.

Within the list of chemicals due to be addressed by the committee are the group of isocyanates, the group of glycolethers and several metals, some of which have been linked to allergic asthma, contact dermatitis, neurobehavioural disorders and reprotoxic effects.

It must also be remembered that, although Commission directives do not yet give OELs for all chemicals, all risks arising from chemicals are governed by the general provisions of Framework Directive 89/391/EC and the specific provisions of Council Directive 98/24/EC.

It is obvious that the Commission has played and will continue to play an important role in the prevention of exposure of workers to harm from dangerous substances in the workplace. According to Article 211 of the Treaty, the Commission has the duty to ensure legislation is correctly transposed into national law. Member States are responsible for the enforcement of national laws transposing the Commission's directives and have a duty to report to the Commission on the national implementation with the aim of highlighting problems which may require the updating or correction of these directives.

The Commission may ultimately bring a Member State before the European Court of Justice if it considers that either there is an implementation problem or the directive is not properly applied.



<sup>(31)</sup> [http://www.europa.eu.int/comm/employment\\_social/index\\_en.htm](http://www.europa.eu.int/comm/employment_social/index_en.htm)

## TORBEN JEPSEN

Danish Employers' Confederation, Chairman of UNICE working group 'Chemicals at work'

# The employers' view: Towards the controlled use of chemicals at work

## How the latest occupational safety and health measures impact on industry

Chemicals have played an increasing role in human welfare and wellbeing, and the modern welfare society cannot exist without chemicals. But where chemicals are used inappropriately, they can seriously damage human health and our environment.

The production, handling and use of chemicals therefore have to be approached with great care in order to prevent occupational disease and injury. Society cannot accept unhealthy working conditions and, in conformity with EU legislation and managerial obligations, it is the duty of the employer to ensure safety and health in the workplace.

While no one will argue with the fact that chemicals contribute to the risk factor at work, the extent of this risk is difficult to assess. Although historical data point to a decrease in exposure to chemicals over recent decades, we have not yet achieved the aim of eliminating ill-health from exposure to hazardous chemicals at work.

The key players — suppliers, employers, employees, their representative organisations and OSH professionals — are still confronted with the ultimate challenge of realising reliable risk assessments and determining the appropriate protective and preventive measures. This challenge also calls for the continuing support of governments through purposeful initiatives.

## The legislative dimension

The safe use of chemicals begins with a risk assessment identifying hazardous properties intrinsic to the chemical and the potency (strength) of these properties. This exercise, resulting in classification and labelling of hazardous chemicals by the supplier to provide the user with core information on potential risks, has been part of EU legislation for many years.

The chemical agents directive <sup>(2)</sup> covering production and use in the workplace stipulates the following:

- determination and assessment of the risk connected with exposure rates prevailing in the workplace;
- substitution;
- the introduction of preventive measures, in line with the risk assessment, designed to eliminate or reduce the risk to a minimum;
- information and training for workers; and
- consultation with workers.

The directive also forms the general basis for setting indicative and binding occupational OELs.

As a very important link in the supply chain, we have the new safety data sheet (SDS) directive (2001/58/EC) dealing with the information to be provided by suppliers of hazardous chemicals to professional users, in order to facilitate compliance with the requirements of the chemical agents directive.

In addition to the abovementioned directives we have specific regulations on carcinogens, for example, and restrictions regarding the marketing and use of certain chemicals. The Seveso directive should also be mentioned in this connection. In short, the conclusion is that the legislative background concerning chemicals in relation to health and safety at work is sufficient.

On the other hand — and in harmony with the White Paper on a future strategy for chemicals — there is a clear need to accelerate the OEL values-setting procedure, especially in respect of carcinogens. The aim must be to focus more specifically on potency considerations and on the relatively simple Technical Progress Committee (TPC) procedure for determining these binding limit values in line with indicative limit values.



INSHT, Instituto Nacional de Seguridad e Higiene en el Trabajo, Spain.

<sup>(2)</sup> Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work.

The 1990 carcinogens directive <sup>(23)</sup> is also a potential candidate for revision in order to bring it more into line with the approach of the chemical agents directive. Potency considerations should be applied in order to differentiate the appropriate measures, rather than just regarding all classified carcinogens as posing the same potential risk.

## The new chemicals legislation (REACH)

The translation of the abovementioned White Paper strategy into a legislative framework is a subject that currently rates a high priority at meetings between those employers with a special interest in chemicals.

One of the objectives of the REACH system (registration, evaluation and authorisation of chemicals) is the generation of reliable data for risk assessment. This will be nothing new for the workplace since, under the existing legislation, employers are already obliged to undertake a proper risk assessment for the activity proposed. So, if they do not have sufficient data for this purpose, they will have to take additional measures, in other words, by using a closed system to eliminate the exposure problem. The degree of basic knowledge necessary therefore depends on the preventive measures in place.

The draft preliminary legislation submitted to employers proposes measures that will be very costly and exceedingly bureaucratic. But whatever the exact form that REACH ultimately takes, manufacturers and importers are likely to withdraw various chemical types from the market. These will probably not be the most dangerous, but rather those substances that are marketed in volumes too small to counterbalance the extra cost. Such a situation could create very serious problems for downstream manufacturers and users in small enterprises in Europe.



INSHT, Instituto Nacional de Seguridad e Higiene en el Trabajo, Spain.

## Problem identification

While EU legislation on chemicals in the workplace is generally sufficient, even if one could wish for an updated version of the carcinogens directive, there are still some challenges in view. One is the fact that legislation has not yet been fully enforced in all Member States. Another — also clearly identified in the chemical agents directive — is the obvious need for guidance documents on risk assessment. Their preparation has been very much delayed at EU level, despite the fact that manufacturers have made substantial efforts to contribute to their development.

<sup>(23)</sup> Council Directive 90/394/EEC of 28 June 1990 on the protection of workers from the risks related to exposure to carcinogens at work and its amendments.

Linked to the question of legislation is also the promotion of OEL value-setting and similar activities that are of great importance in establishing a framework for risk assessment.

As regards the recent SDS directive stipulating that data sheets must accompany all hazardous chemicals, we will probably have to wait a while before the anticipated very positive consequences of this initiative become evident. In this respect the REACH system could most certainly have a favourable influence in the workplace because of its renewed focus on reliable risk assessment both by the supplier and the user — the latter particularly in cases of applications not foreseen by the supplier.

In the chemical agents directive, and in the opinion of many scientific advisors, substitution by a less hazardous chemical is rated the most recommendable measure. But substitution is often a very complicated process in the absence of the supporting models and guidelines relevant to the operation concerned. And one must always bear in mind that the important thing about substitution is to minimise the overall risk.

## Communications

While comprehensive guidance documents on risk assessment and the safe handling of chemicals — supplemented by examples of good practice and developed with the full involvement of the relevant social partners — are indispensable, we will probably not reach our objectives without intensifying communications along the supply chain. The SDS concept is an important element here but, in the case of SMEs, the supplier should be ready to give practical information and advice orally, focusing on all aspects of occupational safety and health linked to the use of his products.

Many small user companies do not claim a high level of competence in chemistry and toxicology. To benefit fully from supplier–user communications, the user needs to develop a safety culture and implement a systematic method of dealing with OSH issues at work. Proper consultation, training and instruction of the workforce are indispensable ingredients. Well thought-out awareness-raising campaigns, developed with the support of the social partners, could very much encourage such a developmental process.

## Specific initiatives

Which specific priorities should be put on the agenda for initiatives in the near future?

Some of these priorities have been mentioned earlier:

- promotion of OEL value-setting activities;
- a more targeted approach to eliminating carcinogenic risks, reinforcing communications along the supply chain;
- promotion of a prevention culture; and
- dissemination of information on the organisation of systematic OSH activities, especially targeted at SMEs.

The implementation of such systems, tailored to the specific needs of companies and without too much attendant paperwork, could be accelerated by the appropriate incentives.

We do not have a full understanding of all the undesirable effects that chemicals can have on human health. One complicating factor is individual susceptibility — inborn or acquired at or outside the workplace.

We need more research in particular into exposure to chemicals that pose the risk of irremediable damage to health, for example



carcinogens, substances that may cause sensitisation or be toxic to reproduction, and endocrine disruptors. These issues are most certainly not linked primarily to workplace exposure, but they are of great public concern and need to be tackled seriously in terms of working environments as well.

Finally it cannot be emphasised too much how important it is to ensure that all our often dispersed but valid scientific and practical knowledge is brought together as quickly as possible and 'translated' into practical solutions for the management of chemical risks in the workplace. All the key players in occupational safety and health have a duty to contribute to this permanent mission.

## MARC SAPIR

Director of the European Trade Union Technical Bureau for Health and Safety

# The workers' view: Unequal protection for employees regarding dangerous products

## A lot needs to be done to make Europe's existing OSH legislation more effective

The theme of European Week 2003 is covered by major European legislation, unlike other themes that are the subject of European publicity campaigns. I am thinking in particular of muscular-skeletal disorders and stress: the European Trade Union Confederation (ETUC) is calling for the adoption of European instruments to ensure the prevention of these problems in the workplace.

Problems linked to dangerous chemical substances in the workplace are covered by a considerable amount of European legislation. Since 1967, regulations, amended several times in the meantime, have been introduced on the placing of dangerous substances on the market and on classification, packaging and labelling of such substances. Since 1976, there have also been restrictions on the marketing of several dozen substances (the lists have been modified in the meantime): this provided the legal basis for the ban, imposed in 1999, on all forms of asbestos, though the first decision to limit the marketing of asbestos had been taken in 1983.

In 1998, the Council adopted a directive providing for the protection of employees exposed to all dangerous substances. Eight years previously, it had adopted another directive to protect workers exposed to carcinogenic agents (there are now 42 substances on the list of confirmed carcinogens, and there is also a list of suspect products). This directive focused on the obligation to replace such products with less dangerous substances, preparations or processes. These last two directives impose only minimum harmonisation of national laws, while the other directives stipulate complete harmonisation in the context of the single market. In this context, the Commission unsuccessfully contested Sweden's decision in 1998 to ban trichloroethane as a carcinogen.

This legislative system will in future be modified by a new regulatory framework for implementing Community strategy on chemical substances and the Commission's work programme provides for the publication of a proposal for legislation this year. The new system should take account of the Globally Harmonised System (GHS) of classifying and

labelling chemical products. The Council of Ministers has asked the Commission to submit proposals to it with a view to integrating this system into the new EU legislation on chemical substances.

## Insufficient implementation

There is a considerable amount of data to show, however, that implementation of these laws in the workplace is still a problem: the lack of figures available itself indicates that legislation is only being partially applied. Based on a survey of the workforce in 1999, Eurostat<sup>(24)</sup> reports that 10 % of European workers declare they are suffering from pulmonary or skin problems related to work. According to a survey by the Dublin Foundation<sup>(25)</sup> in 2000, between 9 and 11 % of workers stated that they inhale dangerous substances in the workplace, whereas only half of them reported handling such substances in the course of their work.

Other research shows considerable variations in the number of workers exposed and in the number of illnesses. The discrepancies concerning exposure arise from the fact that many workers — for instance those in healthcare, construction and agriculture — handle chemicals or dangerous preparations as ordinary tools in the course of their work, despite the fact that their work is not directly linked to the manufacturing and/or processing of these substances and preparations. While these chemicals are essential in these 'user' sectors, they are often given to workers without any prior information on, or training in, the associated risks — and above all without any evaluation by the employer of the risks in the workplace, as laid down in Framework Directive 89/391 which also covers chemicals.

A survey published by the SME Observatory in 1997 confirms that only 38 % of enterprises in the manufacturing sector report having carried out such a risk evaluation. As for the figures on illnesses, the differences in systems for recognising illnesses, and above all in

<sup>(24)</sup> Eurostat, *Statistiques en bref*, 4/2002.

<sup>(25)</sup> Paoli P. and Merlie D. (2001), *Third European survey on working conditions 2000*, European Foundation for the Improvement of Living and Working Conditions.

diagnosis, make any comparisons of national data impossible <sup>(36)</sup>. In addition to these differences, there is the fact that many workers do not demand compensation because they are unaware of the presence of dangerous substances and their potential effects.

The risk evaluation provisions of the European directives imply willingness on the part of employers, as well as the tools to carry them out. The directives do indeed provide some tools: for instance they state that, in the context of the contractual relationship, information must be made available to users by means of labels on product packaging, and SDSs must accompany products and provide comprehensive information for professional users. The authorities have drawn up harmonised labels for approximately 7 000 substances (2 250 existing reference substances and 500 new ones), and a directive defines the type of information to be shown on safety data sheets. They have also laid down exposure limit values, reference tools that should in principle help to evaluate and control risks in the workplace.

There are also risk management models that can help on the issue of substitution — which, I would emphasise, is the main prevention measure stipulated in the directive on carcinogens. This obligation is incumbent on employers, but is often not complied with. Trade union organisations are concerned about this and are calling for the development of substitution procedures and the dissemination of successful practice.

Workers and trade union organisations have developed many tools to identify risks that, in some cases, are the subject of agreements with employers. They conduct publicity campaigns on dangerous chemicals (UNI <sup>(37)</sup> — Europe in the cleaning sector) and are active in ensuring the recognition of certain risks and related illnesses. For instance, national and European campaigns are currently under way on isocyanates (the European Mine, Chemical and Energy Workers' Federation (EMCEF), the European Trade Union Federation of Textiles, Clothing and Leather (ETUF TCL), EFBBWW and Nordic organisations).



Prevent Sweden - Management and Labour improving working environment

Trade unions cover the environmental effects of dangerous chemical substances in their work in order to raise awareness and protect workers. Two examples are CC.OO <sup>(38)</sup> in Spain: use of pesticides in buildings, and SID <sup>(39)</sup> in Denmark: pesticides in agriculture. The unions take part in campaigns in favour of the substitution of various substances such as asbestos, pesticides and certain solvents (FNV <sup>(40)</sup> in the Netherlands). In their battle to have asbestos banned, they negotiated the replacement of products containing asbestos well before the law prohibiting the sale and processing of asbestos and its products was adopted.

## Knowledge of health effects still limited

Current knowledge of the effects of dangerous substances on health, particularly in the long term, is still limited however. It is difficult to know whether this is because of the lack of data or secrecy. Whatever the reason, proper risk evaluation in the workplace is rare if not impossible. The authorities confirm this: the United Kingdom's Health and Safety Executive (HSE) conducted a survey showing that only

<sup>(36)</sup> European statistics on occupational diseases: evaluation of the 1995 pilot data, Eurostat, 1999.

<sup>(37)</sup> Union Network International.

<sup>(38)</sup> Confederación Sindical de Comisiones Obreras.

<sup>(39)</sup> Specialarbejderforbundet (SID), National Union of General Workers.

<sup>(40)</sup> Federatie Nederlands Vakbeweging.

12 % of enterprises had complied with the COSHH regulation on the control of dangerous substances and only 4 % mentioned limit values as a control tool. Most enterprises are unfamiliar with the regulation and just use labels and data safety sheets for information.

Labels harmonised at the European level list the health effects recognised by the directives. For other substances, it is the manufacturers/importers who draw up the labels, based on criteria defined by the authorities. The information provided by SDSs is not always reliable. A HSE study showed that 20 % of SDSs contain errors. A Dutch study evaluating the usefulness of these sheets to SMEs (based on interviews conducted in the Netherlands, Germany and Austria) concluded that they provided little information on protection measures, that the texts were too long-winded and too technical, and that the information provided often contradicted the user's experience.

As a result the information supplied is often perceived by users (employers) as exaggerated. They think that SDSs are instruments designed to help suppliers, importers, and so on offload their responsibilities. It should also be noted that a large number of SMEs in the Netherlands and Austria were not even aware of the existence of these sheets but, when they were, the SDSs were rarely consulted. These enterprises also rarely asked for additional information from suppliers. Moreover the interviews showed that, when drafting SDSs, suppliers did not take into account the ability of SMEs to understand them.



Italy Emilia-Romagna Regional 'Togliamoceci dalla Testa', 'Amianto Stop' Asbestos Campaign.



Kooperationsstelle Hamburg, Germany

It is clear that there is a lack of appropriate information for direct use in the workplace. The European trade unions consider it necessary to develop additional information tools specific to the sector and/or to the work process in which the products are to be used — in a form accessible to users, workers and their representatives.

As for exposure limits, the process of establishing them is slow and cumbersome, based as it is on toxicological information, figures concerning types of use, the number of workers exposed and the type as well as the extent of exposure. Directive 98/24/EC <sup>(41)</sup> provides for

<sup>(41)</sup> Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work.

the establishment of exposure limit values at European level based exclusively on health figures and leaves it to the national authorities to establish a limit value that takes account of the requirements of health protection and technical feasibility.

Limit values established on the basis of incomplete data create added dangers. The limits for many substances have been lowered in recent years, yet other health risks have gradually been identified. This means that workers have been exposed for many years to excessive concentrations. Moreover, throughout Europe, the differences in the number of exposure limit values established in every Member State and the limits themselves are too significant. The lists of carcinogenic substances also vary from one Member State to another, with differences affecting ordinary products: see for instance the campaign by the CSC <sup>(42)</sup> in Belgium concerning glycidol and sulphuric acid. While the European directives strive for minimum harmonisation, the national and European trade union organisations are working to obtain continuing harmonisation of these limit values

and an extension of the lists of substances recognised as carcinogenic.

On the occasion of European Week 2003, Europe's trade unions will endeavour to highlight the shortcomings in the current system and to ensure that in their policies, and particularly when it comes to debating a new regulatory framework, the authorities take full account of the situation of workers exposed to dangerous substances in all sectors, especially in SMEs.

The study conducted by the ETUC on a sustainable system of employee representation and participation in SMEs <sup>(43)</sup> demonstrates just how necessary it is to strengthen the collective representation of employees and to further a European strategy for developing additional resources at both local and sectoral levels. Employee representatives have an essential role to play in changing practices and culture in small undertakings to ensure better health and safety protection for all workers.

## DIMITRIOS REPPAS

*Minister of Labour and Social Affairs*

# A view from the Member States — Greece



### **M**aking safety and health strategy effective in the workplace

Industrial and technological progress has brought changes not only to productivity but also to the development of new methods and products. These changes have produced relatively prosperous societies, but these new working conditions have been detrimental to the safety and health of the working population.

In particular, exposure to dangerous chemical and biological substances at work can seriously prejudice employee health in many sectors of industry: construction, agriculture, metal finishing, woodworking and the service industries too. Adverse effects on workers' health include important occupational diseases such as cancer, asthma, dermatitis, neurological and immunological disorders and target organ diseases.

The main obstacle in effectively countering the risks from chemical and biological agents is the complexity of problems arising from the

large variety of materials and situations. Nevertheless, many improvements have taken place, especially in the more developed countries. These are linked to a better understanding of the toxicity of old and new substances, improvements in classification and labelling, the wider dissemination of information on potential risks, the application of new legislation, and the increased social pressures generated by greater public awareness.

Reactions to potential risks are often polarised as either complete indifference or excessive response. In both cases, what is lacking is knowledge of the real scale of the problem. Risk assessment — a necessary tool in determining the hazards — is imposed on all companies at European level by legislation. Despite this, to date only a small percentage of companies have complied with the regulations. SMEs are particular offenders due, it is thought, to lack of support mechanisms, specialists and equipment. So legislation should not only provide regulatory tools but also promote education and improve the dissemination of information.

Access to information is a critical factor in the prevention of occupational hazards. Effective information includes warning labels or SDSs that suppliers of workplace substances are required to provide through the employer to employees. Adequate information will ensure that management, OSH committees, employee representatives, the relevant public authorities and emergency services have a good knowledge base for policy-making.

It has been 35 years since the European Economic Community, as it was known then, published Directive 67/548 on the classification, 

<sup>(42)</sup> Confédération des Syndicats Chrétiens/Algemeen Christelijk Vakverbond, CSC/ACV.

<sup>(43)</sup> *Working safely in small enterprises in Europe, Towards a sustainable system for worker participation and representation*, David Walters, ETUC publication distributed by the TUTB, 2002.

packaging and labelling of dangerous substances. Although this directive has been amended a number of times since, the safety hazard symbols have become familiar signs to most people: this has been achieved partly through the presence of these symbols in the workplace, but even more through their use on the labels on a wide range of consumer goods.

Since 1980, European Union directives have covered the protection of workers from exposure to dangerous substances of many types and have defined the responsibilities of the various parties involved. In the framework of European Week 2003, the European Agency for Safety and Health at Work is focusing on a programme on dangerous substances involving the exchange of information between all parties in the Member States.

In Greece, statistical reporting of injuries or diseases due to dangerous substances is not undertaken on a permanent basis, but there have been a few systematic surveys that show the extent and level of exposure. While there is a wide range of potential risks due to the sheer variety of dangerous substances and industrial processes, the main problems relate to the nature of the activity and the size of the enterprise.

Heavy industry — cement, shipyards, distilleries, etc. — is mainly confronted with problems associated with dust and solvents, e.g. aromatic and polyaromatic hydrocarbons. SMEs, on the other hand, represent a more diverse range of chemical and biological risks that reflect their wide range of activities, including the use of a great number of solvents, cleaning agents, acids and metals.

Biological agents are also a potential risk for workers in several sectors, including healthcare, sewage, tanneries, abattoirs, the food-processing industry and agriculture. The widespread use of fertilisers and pesticides in farming is also a major hazard.

The service industry category encompasses a wide range of dissimilar activities — tourism, governmental and regional services, finance, consultancy, employment and other private-sector initiatives — but the common denominator here is that the risks tend to be physical or organisational. Cleaning agents are again a serious hazard.

## What Greece is doing

Greek national legislation in the field of occupational safety and health has adequately covered the protection of workers from exposure to dangerous substances by adopting European Union directives. This legislation also defines the responsibilities of the various parties — government, industry and employees — each of which plays a key role in the promotion of occupational safety and health.

Regulation 1568/1985 stipulates that the employer must be aware of all the potential hazards in order to comply with his responsibilities. To accomplish this, he has the right to insist on information such as the SDS from his supplier. Unfortunately, the proportion of employers who exercise this right is small, mainly due to lack of awareness of these requirements. A necessary prerequisite for every purchase should be the provision of SDS documents.

In the last 15 years, Greece has established a number of institutions focusing on OSH issues. These include in-company health and safety committees, services for prevention and protection, a newly reformed Board of Labour Inspectors (SEPE), and a bipartite (employers and employees) Institute for Occupational Health and Safety (Elinyae). Despite this, their impact has not yet had a significant effect on some ingrained attitudes and work practices.

Since the national legislation itself is considered to be adequate, more effective means must be found for its implementation. Greek national strategy covers all those workplaces in which dangerous substances are produced or used. The main principles of the programme are:

1. provision of information; and
2. assessment and control.

The present strategy recognises that, although there has been an increase in both quantity and quality, this information should specifically address the needs of each target group: employers, employees, OHS representatives, OHS practitioners, inspectors, manufacturers and suppliers, scientific and professional groups, and others.

Efforts at national level should include the definition of the roles and responsibilities of the participants; commitment, coordination and cooperation between participants; definition of target groups; assessment of information needs; development of information products and services, and their dissemination.

Nationally coordinated activities include:

- the provision of information in the workplace;
- printed information in the form of leaflets, booklets and fact sheets;
- publicity material in the form of posters, CDs and videos;
- the preparation and production of labels and SDSs;
- the development of advisory documents (guidance notes and manuals) on risk assessment and the control of dangerous substances;
- the promotion of successful good practices and intervention-plan models;
- worker education and training;
- initiatives relating to data collection and statistical monitoring (database on OSH material, workplace registers, exposure survey results, hazardous material incident reporting, etc.).

The Ministry of Labour and Social Affairs, Directorate-General for Health and Working Conditions and its Centre for Occupational Health and Safety (KYAE); the Focal Point of the European Agency; as well as other official bodies such as the Board of Labour Inspectors (SEPE); the State Chemical Laboratory (GChK); the Hellenic Institute for Occupational Health and Safety (Elinyae) and other institutions, are all now involved in a common effort: to inform all parties of their duties in a systematic way and to establish a chain of communication right the way through from suppliers to end-users.

Under this initiative, the Directorate-General for Health and Working Conditions and Elinyae regularly publish books, pamphlets, leaflets and a quarterly magazine, all of which are distributed free of charge. Information material on dangerous substances is now in the editing process. Between 19 and 21 May, during the Greek Presidency of the European Union, Elinyae is organising an international symposium entitled 'Tools for the application of European directives on health in the workplace: the example of chemical risk', under the auspices of the International Social Security Association (ISSA), Research Section.

It is obvious that occupational safety and health cannot be the domain of legislation exclusively. Human wellbeing is a value that cannot be underestimated — for the individual, the family and society in general. The social and economic cost of lost manhours and reduced productivity affects not only the companies themselves but also the social security services. All the links in the chain to a less hazardous environment need to work concurrently in order to be effective, the common denominator being a detailed knowledge of the problems and their possible solutions.

It is up to all the parties involved in Europe to take the initiative in effectively tackling the occupational risks posed by dangerous substances. This means focusing on the provision of comprehensive and targeted information on risk assessment, prevention and control measures, elimination and substitution, and maximising both the dissemination of information and the systematic exchange of experience and good practice.



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# A view from the Member States — Italy



## **A**n exhaustive analysis of the real risks of exposure to dangerous substances

In Italy, growing attention is being paid to worker health and safety and to the prevention of risks from exposure to dangerous chemical agents. A wide range of working activities are affected since the provisions of Legislative Decree 25 of 2 February 2002, implementing the EU Directive 98/24/EC, apply to all working activities in which chemical agents are present (44).

Data from the accident, occupational diseases and national workplace registers, databases of the National Institute of Occupational Safety and Prevention (ISPESL), have been drawn on to illustrate the scale of the situation (Table B), in terms of accidents and occupational diseases caused by exposure to chemical agents and considering the proportion of the workforce potentially affected.

Economic activities (Statistical classification ATECO 91) reviewed in this analysis were those that might be affected by the enforcement of norms on the protection of the health and safety of workers from risks related to chemical agents at work, mentioned above.

The figures for accidents and injuries are based on those reported for the period 1995 to 1999 and compensated by the Italian Worker's Compensation Authority (INAIL) up to 31 December 2000. Cases were examined in terms of combinations of ways of occurrence ('in contact with', 'swallowed', 'inhaled', 'exposed to') and of material agents ('dust', 'gas, vapours, fumes' and 'liquid materials'). Their relative distribution was calculated in line with the classification of economic activities.

As regards occupational diseases, all cases reported in the years 1995 to 1999 and compensated by INAIL up to 31 December 2000 — with

the exception of the ones not associated with exposure to chemical agents (hypoacusia and deafness, osteo-articular diseases, ionising radiation, etc.) — were taken into account. Their relative distribution was calculated in line with the classification of economic activities (ATECO 91).

The relative distribution of work units and workers in the sectors covered, was also featured. Percentages representing the distribution of occupational accidents and diseases respectively over the various sectors were estimated.

National research priorities (Table A) in respect of chemical risk cover the following general areas (45).

**Table A**

<p><b>Management and technology:</b></p> <p>Clean/safe production and products</p> <ul style="list-style-type: none"> <li>■ Substitution of dangerous substances:                             <ul style="list-style-type: none"> <li>• dangerous/toxic substances</li> <li>• carcinogenic/mutagenic substances</li> <li>• relevant risk assessment</li> </ul> </li> <li>■ Waste treatment</li> </ul>
<p><b>Working environment and health:</b></p> <p>Risks in the working environment:</p> <ul style="list-style-type: none"> <li>■ Chemical risk factors:                             <ul style="list-style-type: none"> <li>• dangerous/toxic substances</li> <li>• carcinogens</li> <li>• genotoxic or mutagenic substances</li> <li>• irritants (incl. airways and skin)</li> <li>• respiratory and skin sensitisers</li> <li>• substances damaging to the reproductive system</li> </ul> </li> </ul> <p>Health effects:</p> <ul style="list-style-type: none"> <li>■ Occupational and other work-related diseases:                             <ul style="list-style-type: none"> <li>• diseases caused by chemical risk factors (see above)</li> <li>• diseases caused by a combination of occupational exposures, incl. complex combinations caused by new technologies</li> </ul> </li> </ul> <p>Specific topics related to working environment and health</p> <ul style="list-style-type: none"> <li>■ Development of methodologies:                             <ul style="list-style-type: none"> <li>• exposure assessment</li> <li>• standard setting (occupational exposure limits, etc.)</li> </ul> </li> </ul>

(44) D.Lgs. Governo No 25 del 2/2/02 'Attuazione della direttiva 98/24/CE sulla protezione della salute e della sicurezza dei lavoratori contro i rischi derivanti da agenti chimici durante il lavoro'. GUSO n. 57 del 8/3/02.

(45) <http://agency.osha.eu.int/publications/reports/2002/it/index.htm>

Table B

Economic activity (statistical classification ATECO 91)	% accidents at work (*)	% occupational diseases (*)	Work units (**)	Workers (**)
<b>Manufacturing</b>				
Basic metals and fabricated metal products	10.03	12.31	133 039	313 670
Food products, beverages and tobacco	8.03	2.87	104 444	177 116
Chemicals, chemical products and man-made fibres	5.63	1.88	13 874	113 199
Textiles and textile products	5.16	2.92	110 189	192 308
Machinery and equipment NEC	4.54	5.14	63 613	215 367
NEC	2.91	2.66	78 301	122 034
Electrical and optical equipment	2.54	2.43	77 796	237 187
Other non-metallic mineral products	2.36	8.23	40 064	77 697
Rubber and plastic products	2.29	2.05	18 506	60 072
Transport equipment	2.05	6.66	11 706	71 632
Leather and leather products	1.49	2.40	32 770	56 496
Pulp, paper and paper products; publishing and print	1.46	1.13	47 838	87 008
Wood and wood products	1.35	2.19	63 498	78 759
Coke, refined petroleum products and nuclear fuel	0.21	0.14	1 388	10 706
	<b>Total: 50.05</b>	<b>Total: 53.01</b>		
<b>Construction</b>	11.81	17.18	642 031	647 606
<b>Agriculture, hunting and forestry</b>	11.79	6.40	1 048 131	838 994
<b>Health and social work</b>	9.41	4.53	53 002	154 486
<b>Other community, social and personal service activities:</b>				
Other service activities	5.07	5.15	170 215	161 976
Sewage and refuse disposal, sanitation and similar activities	1.00	0.21	5 263	12 256
	<b>Total: 6.07</b>	<b>Total: 5.36</b>		
<b>Transport, storage and communications</b>	4.86	3.4	226 614	577 661
<b>Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods:</b>				
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	3.99	1.96	195 287	401 351
<b>Mining and quarrying</b>	0.83	7.58	8 911	15 600
<b>Electricity, gas and water supply</b>	0.80	0.45	5 786	91 627
<b>Education</b>	0.33	0.10	29 822	112 589
<b>Research and development</b>	0.05	0.02	2 802	34 717
	<b>TOTAL: 100.00</b>	<b>TOTAL: 100.00</b>		

(\*) Source: INAIL data processed by ISPESL.

(\*\*) Source: ISPESL national workplace register at 1 September 1999.

Table C

<b>Sectors with potential chemical risk <sup>(46)</sup></b>
Cleaning and disinfection (i.e. fumigation) services
Construction
Galvanisation
Health service activities
Laundry services
Leather
Maintenance
Manufacture of metal construction elements
Manufacture of pottery, glass and fibreglass products
Manufacture of pulp, paper and board
Manufacture of rubber and plastic items
Manufacture of vehicle body parts
Textiles
Transport
Waste disposal
Woodwork

(46) G. Bollini 'Valutazione del rischio chimico nelle microimprese' Convegno Nazionale RISCH Prevenzione e Protezione da Agenti Chimici Pericolosi, Modena 27/9/02

## Sectors at risk

The National Confederation of Craft-based and Small and Medium Enterprises identifies a number of sectors where there is a potential chemical risk. These are listed in Table C.

A particular difficulty for these types of firms is acquiring the appropriate information and the relevant solutions. An example of practical action to meet this need is the guidelines entitled 'Protection against carcinogenic agents — work processes exposing workers to hardwood dust' <sup>(47)</sup> produced by the Technical Committee of Regions and Autonomous Provinces. These propose specific prevention and protection measures.

Another example is the TES (Transport Emergency Service) programme — a result of collaboration between the public authorities and

(47) Linee guida 'Protezione da agenti cancerogeni — Lavorazioni che espongono a polveri di legno duro', Coordinamento tecnico per la sicurezza nei luoghi di lavoro delle Regioni e delle Province autonome, Convegno Nazionale RISCH Prevenzione e Protezione da Agenti Chimici Pericolosi, Modena 27/9/02.

companies in the *Federchimica* association — the aim of which is to provide assistance in the event of accidents involving chemical agents transported by road or rail <sup>(48)</sup>. Other solutions may be the dissemination of communication/information packages already developed by firms in the chemical sector, for example corporate databases that provide information on all chemical agents related to the company activities and which can be accessed by employees over a company's Intranet system.

Further significant critical issues on the subject of risks and hazards to health are the use exposure to silica in Italy in some working activities — quarrying, pottery, house/road building, foundries, infrastructure projects, brick and terracotta making, metal polishing, precious metals, sanding, glass making <sup>(49)</sup> <sup>(50)</sup> — and the continued problem of asbestos. The agricultural sector also poses special problems due to the dangerous chemical agents used, the heterogeneity of activities, the presence of seasonal workers including foreigners, and company size <sup>(51)</sup>.

Another area is that of indoor pollution in confined non-industrial residential and working environments, such as houses, public and private offices, hospitals, schools, hotels, banks, cinemas, bars, restaurants, and public and/or private means of transport <sup>(52)</sup>. The main sources of indoor pollution are posed by human beings and the activities they perform, and by building materials, furnishings and air treatment systems.

## Biological agents

It is estimated that the number of workers exposed to biological agents in all the activities covered by Legislative Decree 626/94 is 800 000 to 1 200 000 <sup>(53)</sup>. A large number of sectors are affected, especially the fields of health and research (hospitals, laboratories, pounds, etc.), the food industry, pharmaceuticals, waste disposal and composting, and those areas of industry where biotechnologies are used. These sectors include the production of foodstuffs, medicines, enzymes (amylases) for the production of detergents, and micro-organisms used in pesticide integration (bio-pesticides) <sup>(54)</sup>.

The biological agents to which such workers may be exposed consist chiefly of bacteria, viruses, yeasts, nitrogen-fixing micro-organisms and fungi of the *Penicillium* family. The type of use envisaged seldom requires the use of pathogenic micro-organisms, so the likelihood of contracting infections is low. It is more likely that, depending on the process type, workers are exposed to immunological type effects (bronchial asthma, dermatitis, allergic rhinitis, alveolitis) or toxic effects (absorption of endotoxin and  $\beta$ -1,3 — glucan) <sup>(55)</sup>.

<sup>(48)</sup> [http://www.federchimica.it/pagine/sal/s\\_se\\_01.htm](http://www.federchimica.it/pagine/sal/s_se_01.htm)

<sup>(49)</sup> A. Scarselli, A. Marinaccio, M. Nesti, M. Marconi, 'Occupational exposure to silica in Italy: assessing the extent of workers using administrative data', *La medicina del lavoro*, Vol. 93, supplemento 2002 — Third International Symposium on Silica, Silicosis, Cancer and Other Diseases — S. Margherita Ligure, 21-25 October 2002.

<sup>(50)</sup> P. La Pegna, D. Rughi, A. Terracina, P. Altarocca, U. Verdel 'Linee guida per la valutazione dell'esposizione ad agenti chimici pericolosi non ancora classificati: il caso della silice cristallina' Convegno Nazionale RISCH Prevenzione e Protezione da Agenti Chimici Pericolosi, Modena 27/9/02.

<sup>(51)</sup> ISPESL/Centro Ricerche Economia e Lavoro/Università degli Studi di Catania — Istituto di Meccanica Agraria 'Prevenzione in agricoltura' — Supplemento monografico *Prevenzione Oggi*, n. 1/1997.

<sup>(52)</sup> Linee guida del 27/9/01 Accordo tra il Ministro della salute, le regioni e le province autonome sul documento concernente: 'Linee-guida per la tutela e la promozione della salute negli ambienti confinati' GUSO n. 276, 27/11/01.

<sup>(53)</sup> C. Canegallo, R. Ciliberti, G. Melioli. Il rischio da agenti biologici nel laboratorio di ricerca e di analisi cliniche. *Ambiente e Sicurezza sul Lavoro* n.11: 57-62, December 1997.

<sup>(54)</sup> A.M. Hole, A. Draper, G. Jolliffe, P. Cullinan, M. Jones, A.J. Taylor, 'Occupational asthma caused by bacillary amylase used in the detergent industry', *Occupational and environmental medicine*, 57(12) pp. 840-842. December 2000.

<sup>(55)</sup> D.F. Lieberman, E. Israeli, R. Fink 'Risk assessment of biological hazards in the biotechnology industry', *Occupational medicine*. n.6 (2) pp. 285-299, 1991.

The biggest risk of exposure and consequent development of pathologies is in the pharmaceutical industry, where retroviral vectors and immunosuppressive monoclonal antibodies are used. A biological agent that has only been taken into consideration in recent years is the prion responsible for transmissible spongiform encephalopathy, to which people involved in livestock farming and meat processing may be exposed <sup>(56)</sup>. This self-replicating protein, very resistant to inactivation treatment, may be present as a contaminant in many animal-originated biological matrices used in the pharmaceutical industry.

In terms of exposure to biological agents, the healthcare sector is the one for which most data are available. The most common etiological agents workers are exposed to are the Hepatitis A, Hepatitis B, Hepatitis C and HIV viruses, bacterial infections caused by the *Bacillus*, *Staphylococcus* and *Mycobacterium* varieties, and fungal infections from the *Aspergillus* variety, mainly due to accidental events or the faulty application of safety procedures <sup>(57)</sup>.

Finally, an extremely interesting area for the study of exposure to biological agents is the sector dealing with the disposal and recycling of waste. The nature of the relevant biological agents depends on the processing unit in question, but in most cases workers are exposed to bio-aerosols containing living bacteria, moulds and bacterial mycotoxins and endotoxins <sup>(58)</sup>.

## Legislative framework

Over the past 10 to 15 years, Italy has gradually brought its legislation on occupational safety and health into line with specific Community legislation.

Norms issued after 1992 in implementation of various Community directives (89/391/EEC, 89/655/EEC, 90/394/EEC, 90/679/EEC, 98/24/EC, 2001/58/EC, etc.) have helped to complete and update previous national legislation and to identify entities (including new players), innovative methodologies and concrete objectives for prevention in the workplace. These norms were designed in order to include measures implemented at the time of promulgation and contents to be defined in greater detail by subsequent legislation issued by the Ministries concerned.

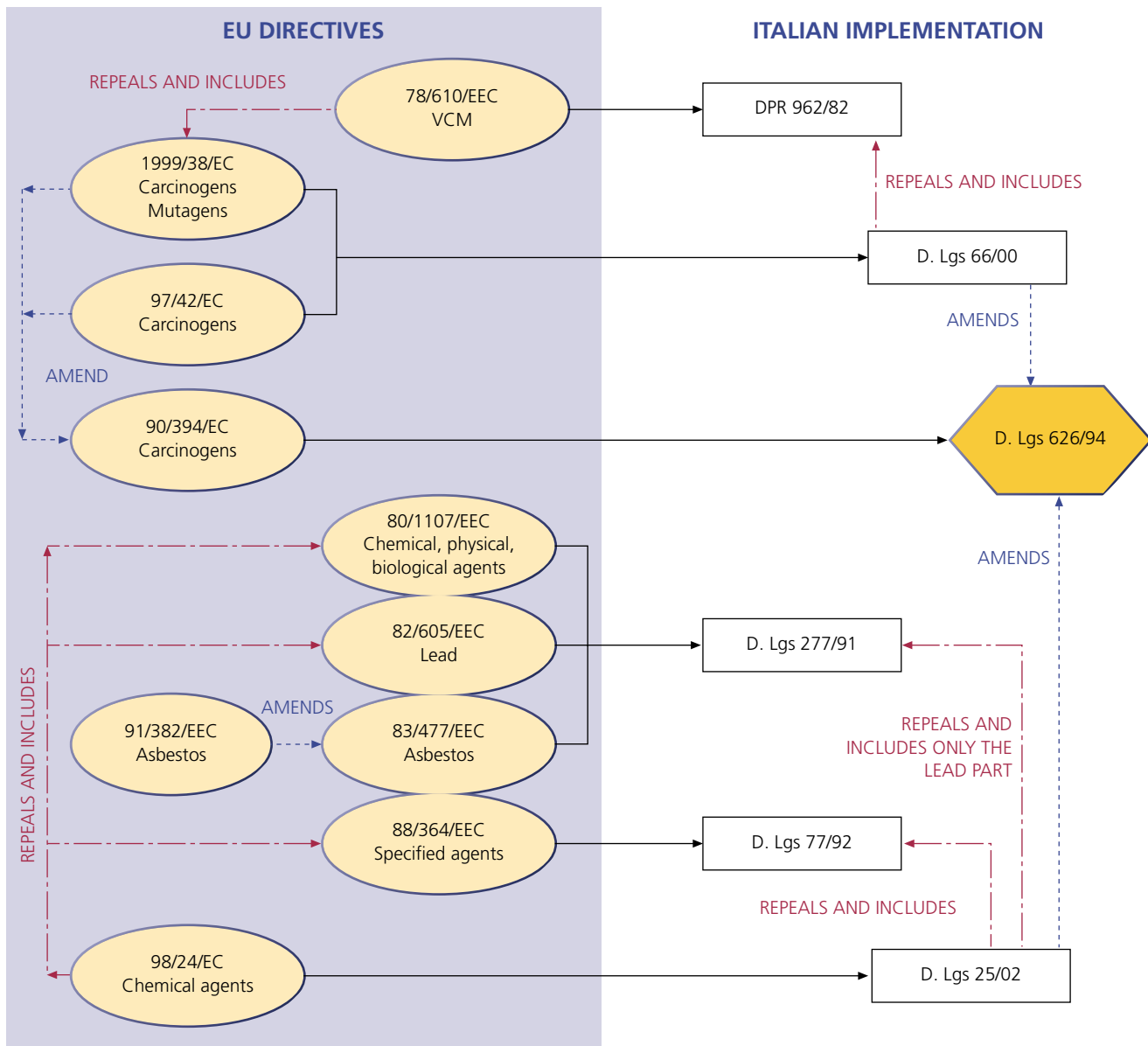
Figure A shows the national legislation, introduced in conformity with Community directives, establishing the minimum requirements for the protection of employees against the risks of chemical agents in the workplace.



<sup>(56)</sup> WHO/CDS/CSR/APH/2000.3, 'WHO infection control guidelines for transmissible spongiform encephalopathies', Report of a WHO Consultation Geneva, Switzerland 23-26 March 1999.

<sup>(57)</sup> A. Franchi, M. Amicosante, E. Rovatti, R. Bonini, P. Marcheggiano, E. Girardi et al, 'Evaluation of a western blot test as a potential screening tool for occupational exposure to *mycobacterium tuberculosis* in healthcare workers', *The Journal of occupational and environmental medicine* n.42 (1): pp. 64-68, 2000.

<sup>(58)</sup> J. Lavoie, S. Guertin, 'Evaluation of health and safety risks in municipal solid waste recycling plants', *Journal of Air Waste Management Association*.



D.Lgs = Legislative decree  
DPR = Presidential decree

## Priority actions

The following priority actions have been decided.

- **Guidelines:** operating instructions related to 'slight risk'.
- **Legislation:** completing the procedure for executive measures provided by legislation on: the definition of 'slight risk'; first aid in enterprises; registers and medical records for professionally exposed workers; occupational exposure limit values and biological limit values.
- **Information and training:** activities covering all key players in the safety scenario (employers, workers, workers' safety representatives, prevention and protection service executives, company physicians, etc.) to meet the urgent need to acquaint SMEs and craft firms with methods of assessing chemical risk, establishing preventive and protective measures, and encouraging the development of a 'safety culture'.

In the sphere of training, the national 'Permanent education in medicine (ECM)' programme aimed at all healthcare workers, including the personnel of the OSH supervisory authorities, will continue. The rapid and continuous development of medical and biomedical knowledge and technical and organisational innovation make it essential to update healthcare workers on technical and scientific progress.

Training initiatives of national interest as identified by the national permanent education commission include: 'Management of chemical, biological and physical risk', 'Promotion of the quality of life and the quality and safety of living and working environments', and 'Promotion of correct and effective communication' <sup>(59)</sup>.

- **Financial support to small and medium-sized enterprises (SMEs)**

<sup>(59)</sup> <http://ecm.sanita.it/>; (18) <http://ecm.sanita.it/presentazione/programma.htm#>



JUDY CAWTE

Health and Safety Executive, Health Directorate, Chemicals Policy Division, United Kingdom

# Risk assessment — e-COSHH Essentials: Quick, easy... and good for business!

## Helping SMEs to manage the health risks from chemicals

### Introduction

Electronic *COSHH Essentials* is a free and interactive web site of simple, step-by-step guidelines produced to help businesses control the health risks from chemicals.

The control of substances hazardous to health regulation (2002), known as COSHH, requires businesses to identify dangers to health from the use of chemicals in the workplace. The United Kingdom's HSE produces a hard-copy publication, *COSHH Essentials* launched in May 1999, which helps businesses assess these risks and protect their workers. The paper version costs GBP 15 (approximately EUR 24).

### Target audience

There are approximately 1.3 million firms in the United Kingdom using chemicals. However, research carried out in 1996 showed that industry, and small firms in particular, had little or no understanding of how the occupational exposure limit system works, nor could they afford to bring in a specialist to help.

Research also shows very limited knowledge of the COSHH and occupational exposure limits among SMEs. Only 16 % mentioned either complying with COSHH or OELs when asked what legal requirements exist for establishments that manufacture or work with chemicals, although most reported taking steps to protect employees. As a result, very little was being done to carry out the requirements of COSHH — not because small businesses were unwilling, but simply because they didn't know what to do.

Furthermore, the research showed that small firms:

- rely heavily on information on labels and SDSs when deciding on how to control chemicals;
- want to be told exactly what they need, and do not need, to do.

To address the needs of small firms, the HSE has worked with stakeholders to provide a tool for them. The tool, *COSHH Essentials*, 'Easy steps to control health risks from chemicals', was launched in May 1999. It provides a simple generic risk assessment which, using basic information, directs users to practical control advice tailored to their chemicals and tasks.

Evaluation of *COSHH Essentials* shows that the majority of purchasers find it easy to use and 75 % took action as a result. Thanks to the success of the paper version of *COSHH Essentials*, the HSE decided to consider how it could improve the product and make it more accessible to business. Although it has attracted interest worldwide, relatively few copies have been sold — particularly considering the large number of small firms using chemicals.

To make *COSHH Essentials* more readily accessible to small firms a free Internet version was launched on 30 April 2002. It is available from the HSE web site, HSEdirect, or at [www.coshh-essentials.org.uk](http://www.coshh-essentials.org.uk). As well as promoting this free Internet tool, the HSE will be looking for partners to work with to make small firms more aware of its availability.

Currently, the HSE estimates that 80 % of businesses have access to the Internet. This web version is already proving very popular, with about as many visitors to the site within three months as paper copies sold in three years. So far, there have been over 48 000 assessments completed, with over 30 000 visitors. Feedback from individual users has been very positive. Typical comments are: 'robust and easy to use, it only allows you to fully complete risk assessments — no half measures, allows you to electronically store risk assessments, useful and practical tool.' A formal evaluation with a questionnaire on the Internet site will be carried out later this autumn.

### How it works

Electronic *COSHH Essentials* carries out an online risk assessment to give businesses practical solutions for their workplace. It simply asks users to input readily available information about the chemicals they use and the way in which they use them. The system then automatically identifies the correct control solutions and produces easy-to-follow instructions on how to put the guidance into practice and carry out other duties required by COSHH. As well as being quicker and easier to use than the paper version, the web-based system has hypertext links throughout so that the user can get access to other guidance. This guidance can also be printed out.

Research has also shown that small firms see the distinctions government make between health, safety and environment as irrelevant to them. They want to know how to control chemicals so as to meet all regulatory requirements. To address this need, work has started on developing 'Chemical Essentials'. This aims to develop the *COSHH Essentials* approach to produce integrated guidance for small firms on controlling health, safety and environmental risks from chemicals.

## Availability

Electronic *COSHH Essentials* is free and can be found at [www.coshh-essentials.org.uk](http://www.coshh-essentials.org.uk), or through the hsedirect web site ([www.hsedirect.com](http://www.hsedirect.com)).

## Contacts

For more information about the electronic version of *COSHH Essentials*, please contact:

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### COSHH Essentials — A summary

*COSHH Essentials* was developed to help firms, particularly small businesses, control health risks from the use of chemicals in the workplace. The guidance pack *COSHH Essentials*, 'Easy steps to control health risks from chemicals' provides:

- a simple checklist-based risk assessment that leads users to a control approach suitable for their chemicals and tasks. There are four control approaches: 1 — general ventilation; 2 — engineering control; 3 — containment; and 4 — users are directed to seek specialist advice for the most hazardous chemicals and tasks;
- practical advice on using the control approaches and advice on getting specialist help;
- 60 illustrated control guidance sheets giving good practice control advice for common tasks such as mixing, weighing, sieving, and additional sheets on avoiding skin and eye contact with chemicals and protective equipment;
- a reminder about other duties under COSHH, and pointers to helpful publications.

To get advice on their chemicals and tasks, users enter on a checklist:

- the hazard group — one of groups A to E, with E the most hazardous and group S representing substances which can cause harm as a result of skin contact — these are based on the risk phrases for the chemical, which are given in Section 15 of the SDS;
- how much they are using: small (grams or millilitres), medium (kilograms or litres) or large (tonnes or cubic metres);
- for solids — how dusty: low, medium or high, based on simple descriptors;
- for liquids — how volatile: low, medium or high, based on boiling point and the temperature at which the chemical is used.

A table then directs users to the right control approach. An index gives a list, for each control approach, of control guidance sheets for common tasks.

An Internet version is freely available at [www.coshh-essentials.org.uk](http://www.coshh-essentials.org.uk). The user enters the same information and the system, using the same risk assessment approach, selects the right control approach and control guidance sheets, which can be printed out. The user can also print out an assessment form showing the information entered and a reminder of the need to implement the controls, consider other COSHH duties and other legislative requirements.

*COSHH Essentials* covers chemicals and chemical preparations supplied for use at work. It does not cover process-generated dusts and fumes, gases, lead and asbestos. Work is in hand to expand the range of control guidance sheets.

## HANS MARQUART

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# The European control hierarchy

## Control measures to minimise workplace exposure and protect worker health

### Introduction

Risks of exposure to chemical and biological agents in the workplace need to be eliminated or reduced as much as possible. To control exposure, several options often exist, from total process changes to the provision of personal protective equipment. The choice between these options is not entirely up to the employer. The European control hierarchy, as stipulated in Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work, presents the order of priority for control measures.

### General description of the European control hierarchy

In general, the priorities set out in the European control hierarchy are:

- substitution and elimination of hazardous substances and processes;
- design of appropriate work processes and engineering controls and use of adequate equipment and materials, in order to avoid or minimise the release of dangerous substances into the workplace;
- application of collective protection measures at the source of the risk, such as adequate ventilation and appropriate organisational measures;
- where exposure cannot be prevented by other means, application of individual protection measures including personal protective equipment.

Furthermore the following action is prescribed:

- reduce the number of workers exposed to a minimum;
- reduce the duration and intensity of exposure to a minimum;
- use appropriate hygiene measures;
- reduce the quantity of dangerous substances at the workplace to the minimum required for the work activity.

#### Simple measures to reduce exposure in printing facilities

- Use squeeze bottles or plunger cans to apply a specific amount of blanket wash to towels in lithography shops.
- Place solvent soaked rags used for cleaning parts in a closed container, rather than leaving them to evaporate solvents on a tabletop.

This:

- reduces cost and chemical use by applying only as much as is needed to workshop towels;
- prevents accidental spills by using a closed container;
- reduces chemical loss and worker exposure by limiting evaporation.



Kooperationsstelle Hamburg, Germany

### 1. Substitution and elimination of hazardous substances and processes

Total process changes can eliminate the use of products containing dangerous substances, for example by replacing a chemical process (solvent cleaning) with a mechanical process (ultrasound cleaning). Substitution of dangerous substances by non-dangerous substances is another option. Substitution can be very successful, but is also very complex. This is discussed in a separate article.

### 2. Control at the source of exposure

Avoiding or minimising the release of dangerous substances into the workplace is the most effective way to control exposure. Exposure of a worker can only occur if a dangerous substance is released from the process equipment or container in which it is kept. This is called 'emission'. The more a substance is kept within closed systems, the less potential for exposure of workers.

A way of eliminating or reducing the emission from a process is by fully enclosing the process. This often requires changes, such as automating several steps and redesigning equipment to allow full enclosure with minimal breaching.



INSHT, Instituto Nacional de Seguridad e Higiene en el Trabajo, Spain.

If total enclosure is not feasible, partial enclosure as, for example, with lids on containers or tanks can still be very useful in lowering emission.

Choosing the right equipment can also reduce emission. Some types of abrasive equipment may cause substantial production of fine dust in a process, while other types of equipment may produce the same result for the product but emit far less fine dust.

Similarly, optimisation of process pressures and temperatures can reduce emission from a system, while maintaining the quality of the process.

### 3. Collective protection measures

If emission cannot be sufficiently lowered, the next step to limit exposure is to eliminate dangerous substances from the working environment before they reach the worker. Local exhaust ventilation (LEV) — which extracts the emission close to the source, thereby preventing contamination of the workroom air — is a very good option as it protects everyone in the work area. Designing and installing effective LEV systems is a specialist task. Improper design, installation, maintenance or use will lead to relatively ineffective ventilation. An indicative evaluation of the design of a ventilation system can be done by structured observation, looking at the distance between the emission source and the inlet of the ventilation system, the presence of air-guiding hoods and the surface area of the source. Systems that are 'less than good' reduce exposure by 55 to 85 %, while 'good' systems reduce exposure by 80 to 99 %. Proper training of workers for the appropriate use and maintenance of LEV systems is essential since a worker can greatly influence the effectiveness of a system by not using it correctly.

#### General guidelines for local exhaust ventilation (LEV)

- Put the inlet of the system sufficiently close to the source.
- Take account of any natural or process-driven airflow. Hot vapours flow upward. Abrasive machines emit dusts with high velocity in a certain direction.
- Direct the airflow to the inlet of the ventilation system by hoods (passive) or by directional airflows channeling the contamination toward the inlet (so-called push-pull systems).
- Make the system 'fail-safe'. For example, provide automatic cut-off for sanding machines if an LEV is not working.
- Teach workers not to block the airflow and not to create unwanted (strong) airflows that interact with the LEV, e.g. by opening windows or doors close to LEV.
- Ensure regular maintenance in order to prevent build-up of contamination that can reduce efficiency in ducts.
- Use short ducts and as few bends and other obstructions as possible to lower the energy needs of the system.

Whereas LEV removes contaminants before they are dispersed through the workplace, general (dilution) ventilation brings in fresh air from outside to dilute and replace the contaminated air. This is less effective than local exhaust ventilation, but can be helpful in lowering exposure, especially if emission is from scattered sources. Also, as LEV is never 100 % effective, general ventilation lowers the resulting (background) contamination. Recirculation of ventilated air should be limited and, if air is contaminated with carcinogens, is generally not allowed.

By clever organisation of work processes, including effective layout of the workplace, emissions and exposures can be reduced to a minimum. Examples are:

- preventive maintenance of transport systems, such as pipes, to prevent blockage and the need to open highly contaminated systems;
- routing processes to avoid unnecessary transport and repackaging;
- performing those tasks with high contamination emission at the end of the day, in order to allow ventilation to reduce exposure levels overnight while workers are absent;
- creation of separate 'dirty' and 'clean' zones in the workplace to allow workers to avoid high concentrations or highly contaminated areas for most of the working day.

These measures generally require proper training of workers and management control to ensure the optimum reduction in exposure levels.

### 4. Sometimes personal protection is needed

Some processes and tasks cannot be covered adequately by control measures at the source or by other collective measures. In that case personal protection is needed. The production, certification and marketing of personal protective equipment (PPE) in the EU is regulated by Council Directive 89/686/EEC of 21 December 1989 and its amendments. Council Directive 89/656/EEC of 30 November 1989 on the minimum health and safety requirements for the use by workers of personal protective equipment at the workplace lays down minimum requirements for the assessment, selection and correct use of PPE. But priority must still be given to collective safety measures.

Personal protective equipment is only to be used if other measures cannot sufficiently reduce exposure. In principle, it should be used only temporarily until higher-priority measures are available.

Use of PPE is widespread. Respiratory protective equipment (RPE) is one of the most commonly used types of PPE in UK workplaces. The United Kingdom's HSE estimates that up to 4 million workers in the United Kingdom currently use some form of respiratory protection at work, while around GBP 200 million (EUR 293 million) is spent each year by employers on the provision of respiratory protective equipment. However, although the use of RPE is widespread throughout industry, health and safety inspections have shown that some employees are not using equipment effectively, either because it is unsuitable or has not been properly maintained, or because workers have not been trained to use it correctly.



INSHT, Instituto Nacional de Seguridad e Higiene en el Trabajo, Spain.



For proper use of personal protective equipment the following steps should be taken.

- Select appropriate PPE, based on a proper evaluation of risks and of the available PPE.
- Take account of the tasks to be done: is the PPE sufficiently comfortable and can the task be done with this equipment? If workers are hindered too much by PPE, they may be inclined not to use it or to use it only intermittently.
- Fit the PPE to the worker. In the case of both respiratory protective equipment and skin protection systems, leaking around the seams is one of the most common reasons for low protective effect. Perform relevant fit tests.
- Educate and train workers on the need to use PPE and the way to use it correctly.
- Provide for regular management control of the use of PPE.
- Clean, maintain and store PPE properly.
- Do not *reuse* PPE that is made for one-time use.
- Replace PPE on a regular basis (based on the risks) and whenever its proper functioning can no longer be guaranteed.

Studies in practice show that PPE does not necessarily give real protection. Assigned protection factors have been derived for adequate and properly used RPE and generally range from 90 to 99 %. Data on skin protection are scarce, but indicate a lower effectiveness: 70 to 90 % protection and sometimes even less.

## 5. Appropriate hygiene measures

Proper facilities for cleaning should be available and workers should not be allowed to eat at the workplace if dangerous substances or biological agents are handled. Also, cross-contamination from the workplace to clean areas, such as the company restaurant or office areas, should be avoided by proper systems for removing gloves and work clothing before entering clean areas. Skin should be cleaned as quickly as possible after contamination.

### Summary

#### Control priorities for effective worker protection from dangerous substances and biological agents

- Only use or handle dangerous substance and biological agents as far as necessary.
- Prevent or minimise emissions (closed systems).
- Prevent or minimise spread of contamination through the workplace (ventilation, separation).
- Protect the worker (PPE).
- Decontaminate where necessary.

And furthermore:

- always educate and train workers regarding risks and the best methods to prevent or minimise them;
- always check whether controls function correctly and are used properly.

## LOTHAR LISSNER

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# Substitution is possible!

## The rationale behind the EU's top-priority risk reduction strategy

Very often when, as a person interested in occupational safety and health, I find myself watching workers handling labelled chemicals, I feel there must be a better solution than having to understand complex handling instructions and wear personal protective equipment. The best solution seems to be a simple one: replace these substances with non-hazardous chemicals, or perhaps with a process that does not require chemicals at all. But how realistic is that?

## Success stories

Substitution is a reality, but still a largely underdeveloped strategy for risk reduction. If you surf the Internet, you will find lots of case studies about successful substitution by companies, authorities or private organisations. Some of them, dealing mainly with asbestos and solvents<sup>(60)</sup>, are available on the homepage of the European Agency for Safety and Health at Work (<http://europe.osha.eu.int/>).

<sup>(60)</sup> See on web site: [http://europe.osha.eu.int/good\\_practice/risks/ds/case\\_studies.asp?tcid=6](http://europe.osha.eu.int/good_practice/risks/ds/case_studies.asp?tcid=6). This page is being continually updated.

## Legislation

### The current legislative situation

Substitution as a risk reduction strategy is at the top of the worker protection hierarchy. It has a high priority in European legislation on exposure control as defined by Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work.

Substitution is also promoted strongly by other EU legislation related to the protection of occupational health and the environment. In addition to the chemicals directive (98/24/EC), Council Directive 90/394/EEC of 28 June 1990 and its amendments on the protection of workers from the risks related to exposure to carcinogens at work — and other regulations concerning environment or public health — all favour alternative, safer methods and substances for use in processes and preparations.

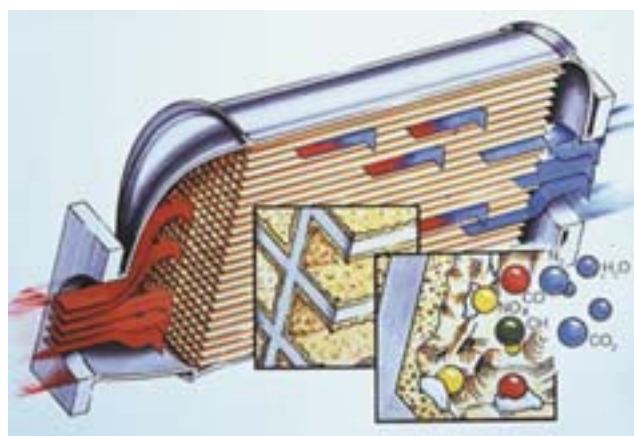
Although national and EU legislation strongly promotes substitution as the top strategy for risk reduction, less advanced measures are still more widely used: emission control, encapsulation of the source process, ventilation, organisational measures and — very much in favour — the use of personal protective equipment.

## The problems in practice

Chemicals at the workplace still represent a significant and serious threat for the health of many workers in various industries. Overall 14 % of all workers are exposed 'to handling or touching dangerous substances' <sup>(61)</sup>. There are more than 100 000 marketed chemicals in the official European inventory of existing commercial substances (Einecs), 30 000 of them with a production volume of more than 1 tonne <sup>(62)</sup>. Nowadays, in all sectors of the working world — agriculture, construction, general industry and services — a huge variety of chemicals is used.

The production of chemicals has constantly increased over past decades. Well-known examples of products used daily are plastics, paints, photochemicals, colourants, pharmaceuticals, cosmetics, biocides, chemicals for the electronic industry, for food processing or for construction purposes. Every industrial sector needs chemicals as process chemicals, as products components or as additives.

However substitution is not only a problem related to the use of well known chemicals. New problems arise from new substances, newly developed products and new work processes. One example is the recycling of catalysts from cars to recover the valuable heavy metals, a procedure unknown 10 years ago. During this recycling process, workers are exposed to ceramic fibres from the catalyst. These fibres are classified as carcinogenic.



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## Do substitution case studies help?

Over the last 100 years, conventionally used substances have been replaced by less hazardous ones in many sectors. Bans or partial bans, involving for example substitution of asbestos by other fibres, of solvent-based paints by water-based paints and of chlorinated additives in cutting fluids by less harmful ones, have led to remarkable changes. Heavy metals such as lead, chromium and cadmium have also been replaced by less harmful substances in certain applications.

### Case 1: Asbestos

The long and endless tale of asbestos is one of the most prominent substitution stories. Worldwide consumption still exceeds 2 million tonnes <sup>(63)</sup>, although the EU and many other States have banned the use of asbestos almost completely. Asbestos is a natural fibre perfectly suited technically for insulation, filtering and fire protection applications. Its physical structure, in particular the size of the fibres, combined with its long life make asbestos so effective — and at the same time so dangerous.



Hauptverband der Berufsgenossenschaften, Germany

Occupational asbestos diseases were already recognised in the 1920s, based on significant medical evidence. However, the amount of asbestos used grew constantly, from approximately 300 000 tonnes in 1925 to more than 5 million tonnes in 1975.

Asbestos has been in use for 100 years, but substitution started only 20 years ago. More than 3 000 substitutes have been developed, most of them with much lower hazard levels for workers. Although there is some concern about these substitute fibres, they have in general a lower carcinogenic effect and a shorter lifetime in the human body than asbestos.

Table 1. Groups of asbestos substitutes

Main asbestos uses	Substitute materials
Fibres for insulation	Glass, mineral and other fibres
Fire protection	Glass, mineral and ceramic fibres
Filters	Special plastics (PTFE and others)
Brakes and clutches	Metallic fibres and carbon fibres
Asbestos cement	Glass fibres, mineral fibres, organic and plastic fibres
Gaskets	Ceramic fibres, PTFE, graphite

<sup>(61)</sup> EU-OSHA, Monitoring the State of Occupational Safety and Health in the European Union — Pilot Study, p. 145.

<sup>(62)</sup> White Paper on a strategy for a future chemicals policy, COM(2001) 88.

<sup>(63)</sup> Buckingham, D., Virta, R., 'Asbestos statistics', US Geological survey, 2002.

## Case 2: Methylene chloride

Methylene chloride is a chemical widely used for stripping paint from different materials. The use of paint removers totals about 30 000 tonnes per annum in Europe <sup>(64)</sup>. Methylene chloride is very effective, but can cause chronic and acute damage to health and sometimes even fatal accidents when applied in confined spaces. The EU has classified methylene chloride as a category 3 carcinogenic, 'Substances that need attention due to their possible carcinogenic properties for humans'. The chemical has to be labelled as Harmful (Xn), with the risk phrase R40 (possible risk of irreversible effects).

Many substitutes for methylene chloride — based on alkalines, esters or dibasic esters — have been developed. The following table compares the use of methylene chloride and these substitutes. The main difference in working conditions is the need with methylene chloride to use personal breathing protection equipment, which also incurs additional physical strain for workers.

Table 2. Methylene chloride — PPE and costs

<b>Methylene chloride</b>
<b>Necessary personal protective equipment</b>
<ul style="list-style-type: none"> <li>• Glasses</li> <li>• Gloves made of fluorine rubber</li> <li>• <b>Breathing protection independent of the ambient air</b></li> <li>• Single-use protective clothes</li> </ul> Total costs: EUR 2 600
<b>Substitutes such as alkalines or dibasic esters</b>
<b>Necessary personal protective equipment</b>
<ul style="list-style-type: none"> <li>• Glasses</li> <li>• Gloves made of polychloroprene, nitrile rubber</li> <li>• <b>No breathing protection (except A1 to P2 mask for spraying processes)</b></li> <li>• Single-use protective clothes</li> </ul> Total costs: EUR 75

Even though the cost-benefit calculation, as shown in Table 2, is unfavourable for methylene chloride, this substance is still widely used and dominates the market. The fast mode of action, the broad range of effectiveness — and, last but not least, the low enforcement of OSH rules in this sector — still make methylene chloride the favourite chemical with users.



Arbejdstilsynet, Denmark.

<sup>(64)</sup> Tukker, A., Simons, L. Ph.; *Methylene chloride: Advantages and drawbacks of possible market restrictions in the EU*, Final Report for DG III of the European Commission, Brussels, Belgium.

## Where to start — key substances

Information on dangerous substances can come from a number of sources. One of the easiest, though rough, ways to compare potential dangers from substances is to look at the classification and labelling information such as symbols and R and S phrases on the packaging or contained in the material safety data sheets (MSDSs).

The first step should be to substitute or eliminate the most hazardous substances. It is a good starting point to assess the risk properties using national guidance.

The main target should be to avoid:

1. highly toxic and toxic substances — generally labelled with the risk phrases R 23, R 24, R 25, R 26, R 27, R 28, R 29, R 31, R 32 and combinations of these phrases (according to the classification and packaging directive, Directive 67/548/EEC, Annex I);
2. carcinogenic, mutagenic and reprotoxic substances (often called 'CMR') — generally labelled with R 40, R 45, R 46, R 49, R 60, R 61, R 62, R 63, R 68 and combinations of these phrases <sup>(65)</sup>;
3. sensitizers <sup>(66)</sup> — generally labelled with the risk phrases R 42, R 43 or R 42/43 (according to the classification and packaging directive, Directive 67/548/EEC, Annex I and VI);
4. endocrine disruptors <sup>(67)</sup> — not labelled up to now.

For some of the substances concerned the EU has provided a full risk assessment, covering possible environmental, occupational health and consumer concerns. Many of these risk assessments are still ongoing <sup>(68)</sup>.

For the future it might be helpful to reconsider the use of 140 commonly used chemicals that are named in the existing substances regulation <sup>(69)</sup>. They are due to be assessed in the coming years by EU authorities for their risk to health and the environment.

This list is based on the 'black lists' of some Member State authorities that support substitution by providing positive and negative lists. These negative lists identify a number of substances where stricter regulations can be expected, due to their hazardous properties, and where the user should try to find substitutes as a measure of precaution. Examples of such negative lists are:

- the OBS list <sup>(70)</sup> by KEMI, Sweden;
- the list of undesirable substances <sup>(71)</sup>, Miljøstyrelsen, Denmark.

Professional groups such as the automotive industry and the Association of Consumers of Industrial Lubricants have their own black lists.

<sup>(65)</sup> <http://europa.eu.int/comm/enterprise/chemicals/markrestr/cmrlist.pdf>

<sup>(66)</sup> The Member States of the European Union have common legislation for sensitising substances, laid down in Directive 67/548/EEC. About 230 substances are classified as sensitising based on this directive.

<sup>(67)</sup> See substances under [http://europa.eu.int/comm/environment/docum/01262\\_en.htm](http://europa.eu.int/comm/environment/docum/01262_en.htm)

<sup>(68)</sup> <http://ecb.jrc.it/existing-chemicals/> click to 'Online European risk assessment tracking system'.

<sup>(69)</sup> Council Regulation (EEC) No 793/93 of 23 March 1993 on the evaluation and control of the risks of existing substances, and the following four priority lists issued up to 2000.

<sup>(70)</sup> Sweden, National Chemicals Inspectorate, OBS-List, Examples of substances requiring particular attention, (OBS-listan: Exempellista över ämnen som kräver särskild uppmärksamhet), second revised edition, 1998.

<sup>(71)</sup> <http://www.mst.dk/homepage/default.asp?Sub=http://www.mst.dk/chemi/01000000.htm>

Another type of list defines in the positive sense which substances (preparations) should preferably be used. Examples are:

- the list of preferable colourants <sup>(72)</sup>, BAuA, Germany;
- the joint BG/HSE/CNAMTS/ISPESL <sup>(73)</sup> Protocol on Improved Conditions of Use of UV Technology in the Printing Industry in Germany, United Kingdom, France, Italy and other interested Member States of the European Union.

Several models have been developed to assist the decision on substitution. The easiest versions, such as the German 'Column model' <sup>(74)</sup> (BIA, Germany), or the 'Seven steps to substitution' <sup>(75)</sup> (HSE, United Kingdom) are also relevant for small and medium-sized enterprises. Larger enterprises can use more precise, but also more complex, comparative assessment tools.

### Examples from the EU list of priority substances with implications for OSH



### Lessons for today

Substitution of a widely used chemical is a long-term process that requires effective action. Hazardous chemicals do not disappear of their own accord. It is only realistic to assume that fast solutions for all the problems encountered will not be forthcoming. Many actors and factors influence the process, and not always in favour of a less hazardous solution.

Taken all together, these are steps toward the use of inherently safe products that reduce the risks for workers. This will reduce the burden of responsibility for the safe handling of dangerous chemicals and — most important of all — the risks to human health and life.

### Guidance for substitution

- Collect information about substitutes.
- Try to adapt this information to your situation.
- Compare the alternatives — risk assessment for the currently used option and the alternative.
- Take into account the potential regulatory and technological implications for the quality of the product, the costs to be incurred including the investment necessary, and the qualifications and training essential for the new process.
- If you are not sure if the substitute is really a better solution, then encourage the further development of better substitutes.



<sup>(72)</sup> Federal Institute for Occupational Safety and Health Germany (BAuA), Recommendable new substances: Colourants, Evaluation of the notifications in accordance with the Chemicals Act, available at <http://www.BAuA.de/english/prax/chem/index.htm>

<sup>(73)</sup> [www.radtech-europe.com/download/UVProtocol-Eng.pdf](http://www.radtech-europe.com/download/UVProtocol-Eng.pdf)

<sup>(74)</sup> <http://www.hvbg.de/d/bia/prax/modell/spaltee.htm>

<sup>(75)</sup> <http://www.hse.gov.uk>



## PENTTI KALLIOKOSKI

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# Controlling worker exposure to waste products

### The risks posed by product dusts, particles and exhaust gases generated during work

Many workers are exposed to processing and combustion waste products such as mineral, wood and metal dusts, and exhaust gases. These waste products — which can pose severe health risks, particularly as a result of exposure over long periods of time — are commonly the result of manual operations such as grinding, where the worker is close to the source and exposed to high concentrations of the material.

The problem may be exacerbated by these substances not being covered by the European Union’s risk assessment programme for chemicals and, due to their having no economic value, their control not being seen as a priority.

#### Examples of potentially hazardous and common waste products

- Dusts generated during mechanical treatment of materials (e.g. wood dust from sawing, metal dust from grinding)
- Emissions containing gaseous pollutants (e.g. ozone, oxides of nitrogen and carbon monoxide in welding)
- Exhaust gases from engines (e.g. diesel engines) that contain both gaseous pollutants and particulates



INSHT, Instituto Nacional de Seguridad e Higiene en el Trabajo, Spain.

### Health effects from common exposures

Substance	Health outcome	Sectors and activities
Crystalline silica (quartz)	Silicosis, lung cancer, non-malignant renal disease	Agriculture, construction, mining, stoneworking
Wood dust	Nasal cancer	Forestry, woodworking
Chromium and nickel compounds	Cancer, respiratory sensitisation	Metal finishing (e.g. plating)
Cobalt fume	Hard-metal lung disease, respiratory sensitisation	Metal finishing

### The health risk from particulates

The health hazards due to particulate exposures depend largely on the size of the particles. Particles larger than ca. 10 µm are mainly deposited in the upper region of the respiratory tract. Particles that penetrate below the larynx are classified by CEN into thoracic and respirable fractions based on the penetration of particles to the thoracic and alveolar regions. The border between these fractions is about 4 µm.

Recently it has been observed that fine particles increase morbidity and mortality due to respiratory and cardiovascular causes, especially among persons with a pre-existing disease. Epidemiological studies have

demonstrated an association with exposure to urban PM2.5 (i.e. particles smaller than 2.5 µm). There is evidence that the largest risk is caused by ultra-fine particles that are smaller than 1 µm or even smaller than 0.1 µm.

Diesel soot particles are examples of ultra-fine particles. Particles generated by mechanical means (e.g. grinding) are generally quite large, but small particles may also result. Generation of ultra-fine silica aerosol has for example been observed during grinding and drilling of rocks. Although the risks of exposure to these kinds of adverse health effects for healthy workers are not yet known, the significant inflammation potency of ultra-fine particles observed in toxicological experiments raises concern.

## Substitution is the preferable control method; alas rarely applicable

European directives clearly state that the primary method for dealing with risks from dangerous substances is their elimination from use or substitution with a less dangerous material or method. However, this alternative is rarely applicable for control of the type of emissions considered here, especially on the material side (only common materials are included). As far as the methods used are concerned, there are some possibilities: for example, welding can sometimes be replaced with riveting, or bending and grinding can be avoided by hiding the unfinished part under a moulding.

## Source control is important

It is crucially important to capture the emission at source before it disperses into the working environment. Generally the best choice — enclosure of the process — is not possible either, so we have to rely on ventilation control. Good control can be achieved with well-designed LEV: there are several manuals available offering reliable design principles. It is crucial to obtain a sufficient capture velocity for the impurities released and, because the efficiency of an exhaust diminishes rapidly with distance, it is important to install the exhaust hood as close to the source as possible. If the work is not limited to a certain fixed site, good transferability of the exhaust is essential for efficiency.

Low-volume, high-velocity exhaust systems are useful in portable tools: besides being effective, they will also be used automatically because the exhaust is attached to the tool. But, as the exhaust duct increases the weight of the tool, it is essential to counterbalance the tool with a swinging arm. Catalytic cleaners have also been developed to control diesel soot emissions, but these are not yet widely used.

## Take advantage of the original release direction of the emission

A 'receiving' exhaust hood is more effective than one that has to capture the contaminant actively, so it should be designed so that it picks up the emission from a specified direction. Emissions from hot sources rise upwards and, in such cases, a canopy hood is effective. It should, however, be installed so that the worker does not have to work with his or her head between the source and the hood.

## Avoid eddies

In manual tasks, exposure cannot be effectively controlled with general (dilution) ventilation on its own, but the latter still has an important role to play because complete control is difficult to achieve with exclusively local exhaust systems. General ventilation uses clean air to dilute the remaining emissions not captured by the LEV, but this supply airflow must not interfere with their functioning. Nor should there be other air disturbances (currents or eddies) in the area where local exhaust ventilation is used, because their velocities can easily exceed that of exhaust flow and may cause significant reduction in capture efficiency.

If emissions are warm, then the use of air replacement ventilation is advantageous when cool make-up air is supplied to the room at low velocity near the workers. The warmed, dirty air rises upwards and is removed from the upper accumulation zone of the room. Studies have demonstrated that this kind of ventilation system is more effective than conventional mixing ventilation if there are no cold walls

inducing downward air currents. The problem of dirty air diffusing along the ceiling and down cold walls can be prevented by partial walls, but each zone bounded by the partial walls needs its own exhaust system.

Vehicle drivers' exposure to diesel soot can be diminished by providing the driver's cabin with effective filtration of intake air.



Allgemeine Unfallversicherungsanstalt, Austria

## Remember skin exposure

Approximately 30 % of the agents on the OEL lists of various countries carry skin notations that indicate these chemicals are fully capable of penetrating the skin. This may seem like a high percentage, but it is probably too low. It has been found that several chemicals have this ability, including metals such as chromium, cobalt and nickel. In addition some chemicals that are harmful to the skin, such as irritants and sensitisers, are not even provided with a skin notation. The list of known sensitisers currently totals more than 3 500 substances.

Skin exposure does not occur by direct contact alone. Indirect contact — via contaminated surfaces, tools and clothes — may be equally or even more important. Good general workplace hygiene is essential: floors should be vacuum-cleaned and not swept with a broom, because this disperses the dust back into the air.

## Personal protection

In-plant emissions cannot always be controlled sufficiently by engineering means alone, so workers may need to wear respirators. It should be ensured that these are of the right type and, in addition, they should be cleaned and changed regularly. The use of air-purifying filter devices should be limited to tasks of short duration because of the significant breathing resistance. In regular use, powered air-purifying or air-supplied respirators are preferable.



INSHT, Instituto Nacional de Seguridad e Higiene en el Trabajo, Spain.

## Summary

There are several potentially hazardous processing and combustion waste products — mineral, wood and metal dusts, and exhaust gases — that are not covered by the EU risk assessment programme for chemicals. As waste, they are also often neglected in the risk management of workplaces. However, these agents are common and the number of workers exposed to them very large. In addition, exposure is often linked with manual work and exposure levels are heavy in the absence of proper engineering control measures. Because substitution is only rarely possible, source control with LEV systems is generally the most effective solution, with additional personal respiratory protection where necessary.



## POUL E. ANDERSEN

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# The Danish product register — A national register of chemical substances and preparations

**A** dangerous chemicals database that combines ease of access with versatility

## Background

The growing feeling of insecurity with chemicals during the 1970s in Denmark led to demands for a better understanding of the influence of chemical substances on the working environment and nature. Not only did employees make such demands, but employers who had to use chemicals in their production processes also wanted to know more. This meant not only having more information on the effects of specific chemical substances, but also knowing which substances were hidden behind the trade names of these products.

The subsequent political proposal for a full declaration on labels for chemicals, however, was not compatible with the trade secrets and economic interests of the producers. So it was made mandatory for producers and importers to supply information to the authorities, giving governmental bodies working in the area the necessary insight to control labelling and SDSs, to follow chemicals through the supply chain, and to utilise the knowledge obtained from their investigations for proper guidance and regulation.

It was principally the Environmental Protection Agency and the Occupational Safety and Health Administration that needed more information. However, a number of other authorities had similar needs, for example, to handle accidents and poisonings, and to control foodstuffs, medicines and the transport of chemicals.

## Foundation

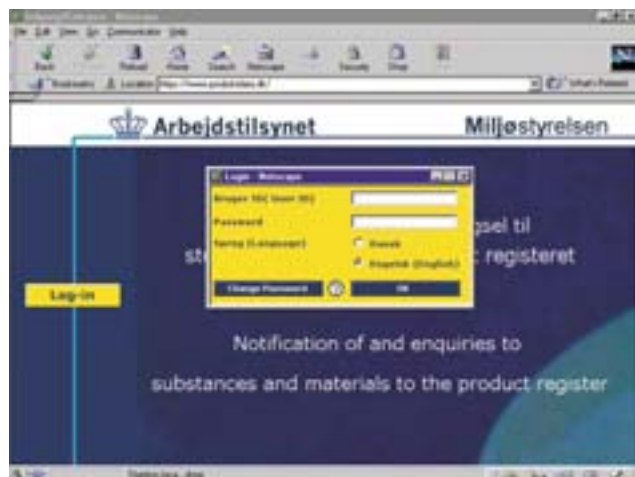
After a study of requirements, options and similar initiatives in other countries, the Danish Ministers for Labour and for the Environment agreed on the creation of a common database with information on chemical substances and preparations.

Data on dangerous chemicals, starting with pesticides and preparations based on asbestos, polyurethane and epoxy resins, were to be collected and stored in this database. Receiving and processing notifications and database management were placed in the hands of the Occupational Safety and Health Administration. Subsequently, the authorisation to develop a register was included in the working environment law, and the basic rules for notification were part of the notice on substances and preparations. In 1980 the Product Register Department was established and in 1982 the database, called Probas, was ready for use.

## Content

The registration of chemicals started out as a fairly ambitious project and amassed a great variety of data types. The general idea was that producers and importers of dangerous chemical substances and preparations should undertake to submit all relevant data to a single central register, and that any authority with responsibilities in the area would be able to get all the information required from this register.

This was seen as a way to prevent the increasing demand for knowhow leading to a situation where suppliers of a given chemical preparation were asked to give the same information many times over to different authorities.



Entry page to the Danish product register (restricted access)

The basic files in the register cover identification of:

- enterprises (17 000, of which 10 000 are Danish);
- chemical substances (140 000, of which more than 14 000 are components in registered products);
- preparations (more than 100 000, of which 35 000 are dangerous end-user products and still in use).

Data fields for substances are:

- names (synonyms);
- identification numbers (e.g. CAS, EC, UN and CI);
- occupational exposure limits;
- EU classifications, etc.

For preparations the most important fields cover:

- composition;
- categories of use (technical function and industrial sector);
- volumes (produced/imported/exported).

Since much of the information processed constitutes trade secrets of major economic value to manufacturers, the register (computers and buildings) incorporates a maximum of security measures against unauthorised access, and the information is treated as highly confidential.

## Collection of information

Information is submitted to the product register by Danish producers and importers of dangerous chemical substances and preparations. In some cases notification is handled by consultants and, in the case of imported products, data on composition are often sent directly by the foreign manufacturer.

About 5 000 new products are notified each year, and roughly 3 000 existing product data sets are revised or inactivated annually. Until now most information has been submitted on paper, in other words, in the form of completed notification forms or direct printouts from computer files at the production site.

Since 1999 it has been possible to have online Internet access to the register database. Companies can submit new notifications in this manner and can sift through existing information as well as general registered substance data. More than 400 users in 300 different enterprises use Internet access and about 800 notifications have been received in this way. These numbers are still increasing.

Consideration is now being given to an enhancement of this service, by making it possible to export data directly from a company computer to the register without having to fill in the electronic notification forms.

## Use

Control of labelling and SDSs, and guidance of users, can be achieved by looking up data on the preparation in question. The register is also used in this way by the Emergency Management Agency and the Poison Control Centre when accidents involving chemicals occur.

Additionally, after some years of data collection and consolidation of quality routines, it has been possible to use aggregated register data to map the use of chemical substances. The following list shows examples of the use of register data:

- documentation of downstream use for risk assessment of existing substances in the EU;
- mapping the use of candidate substances for EU classification as environmental hazards;

INDUSTRIAL SECTOR	Number products	Amount t/y
Building and civil engineering	4 751	5 123 085
Manufacture of chemicals and chemical products	3 309	3 146 616
Sales, maintenance and repair of motor vehicles and motor cycles	4 640	2 032 092
Manufacture of textiles	764	1 619 803
Manufacture of non-metallic mineral products	327	1 508 905
Electricity, gas, steam and hot water supply	198	1 136 629
Water transport	94	1 104 632
Manufacture of rubber and plastic products	1 655	289 437
Manufacture of food products and beverages	1 754	250 853
Extraction of crude petroleum and natural gas	753	204 570
Manufacture of other transport equipment (excluding automobiles)	2 113	194 043
Manufacture of metal articles	4 456	188 881
Sewage and refuse disposal, sanitation and similar activities	112	178 468
Private households	1 953	176 220



- mapping organic chlorine compounds and high production volume chemicals in the Nordic countries;
- prioritising candidate substances for the establishment of occupational exposure limits (in Denmark and the EU);
- survey on cleaning and washing agents;
- survey on chemicals used in different industrial sectors (e.g. printing and auto repair);
- mapping carcinogens before and after establishing rules for carcinogenic substances and preparations;
- general guidelines for occupational safety and health in most industrial areas.

The Danish National Institute of Occupational Health uses the product register to obtain information on the occurrence of substances and the composition of preparations. These data have been used for international publications and handbooks, especially in the area of dermatology and allergens (e.g. *Handbook of occupational dermatology*, 2000).

Figure 1 indicates the industrial sectors where the largest quantities of the registered chemicals are used. The number of products and yearly volumes are shown for 14 industrial areas (NACE 2-digit level).

## International relations

As well as in Denmark, there are well-established product registers in Norway, Sweden, Finland and Switzerland. The product registers in the Nordic countries in particular cooperate closely and contribute data to international work in, for example, the EU institutions and the OECD.

In 1991, the European network of product and exposure registers was established at the initiative of the European Foundation for the Improvement of Living and Working Conditions during a meeting at the National Institute of Occupational Health in Copenhagen. In 1992, it was decided to divide the initiative into two working groups: one for exposure registers and the other for product registers.

The latter included members from Norway, Sweden, Italy, France, Germany and Denmark, and the Danish product register coordinated the work. An important activity of the group was to establish common reference systems for the core information sets of these product registers. The group agreed on the NACE code for industrial sectors of users of chemicals. They also agreed on a coding system for the technical function of chemical products: a modification of the EU code for the notification of new substances.

When, later in the 1990s, the European Agency for Safety and Health at Work was established in Bilbao, the foundation scaled back its involvement on work environment topics, and the activities of the network terminated.

Under the aegis of the Nordic Council of Ministers, a working group was formed two years ago on the premises of the Nordic Chemicals Group to enhance the utilisation of the Nordic product registers. The main initiative of the group since then has been to build a joint Nordic database, due to be freely available on the web, on the use of substances in chemical products. The database contains only aggregated, non-confidential data, and will include information on potential consumer exposure to these substances in the Nordic countries. This database, SPIN<sup>(76)</sup>, is also available on CD-ROM, and is expected to be of great value for risk assessment work where information on downstream use is needed.

## ANNETTE KOLK

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# M

## anaging biological hazards in the workplace

### Biological agents: their nature, their implications and how to handle them

#### Biological agents — definition

Biological agents, mainly micro-organisms like bacteria, fungi (yeasts, moulds) and viruses, are ubiquitous in the environment. These micro-organisms are so called because they are very small in size and single organisms are not visible without the use of optical instruments like microscopes. Biological agents, in the meaning of Directive 2000/54/EC on the protection of workers from risks related to exposure to biological agents at work, also include genetically modified micro-organisms, cell cultures and human

endoparasites which may be able to provoke any infection, allergy or toxicity<sup>(77)</sup>.

Most bacterial cells are less than 1 micrometer (µm) wide and 1 to 5 µm long. Compared to fungal cells, they do not have a real nucleus with a nucleus membrane and chromosomes, which is why they are also called 'prokaryotes'. Bacterial cells do not differ very much in shape: the basic forms of these organisms are balls or rods, and the latter may be straight, curved or curled. Some of them are equipped with flagella for mobility.

A special staining procedure for the cell wall permits a differentiation between gram-negative bacteria (one-layer murein-net plus



<sup>(77)</sup> Directive 2000/54/EC of the European Parliament and of the Council (p. 18), September 2000, on the protection of workers from risks related to exposure to biological agents at work (seventh individual directive within the meaning of Article 16(1) of Directive 89/391/EEC), OJ L 262, pp. 21-45.

<sup>(76)</sup> <http://www.spin2000.net>

lipoproteins, lipopolysaccharides and other lipids) and gram-positive bacteria (multiple-layer murein with few proteins or polysaccharides but always containing teichonic acids).

One of the main characteristics of bacteria is the ability to multiply at very high rates by dividing into two cells if living conditions are optimal (oxygen content, temperature, humidity, pH, availability of nutrients). Some bacteria form endospores to resist environmental conditions that threaten their lives such as UV radiation, heat, dryness and chemical disinfectants. The very small cells of actinomycetes (0.5 to 1.5 µm long, gram-positive, rod-shaped bacteria that are often isolated from soil, for example, and form long threads in the air or substrate) are also called 'spores' <sup>(78)</sup> <sup>(79)</sup> <sup>(80)</sup>.

Fungal cells form threads (moulds) or chains of bubbles (yeasts) up to 10 µm in diameter. Such fungal threads are called hyphae and many hyphae form a fungal weave that is called mycelium. Fungi build up

spore carriers (conidiophores) from this mycelium and the size of these asexual fungal spores (conidia), which are formed in masses and spread by the air, is 2 to 8 µm. Compared with bacteria, fungi have real nuclei and chromosomes and therefore belong to the 'Eucaryotes' group. Only very simple forms of fungal spores are mobile by virtue of their flagella <sup>(78)</sup> <sup>(79)</sup> <sup>(80)</sup>.

Viruses are much smaller than bacteria or fungal cells and measure only a few nanometers (nm). They are obligate intracellular parasites and can infect all living organisms. Because they themselves cannot form cells and therefore are not able to reproduce without having infected host cells, they are not called 'organisms' but 'infectious units'. They consist of nucleic acid (desoxyribonucleic acid (DNA) or ribonucleic acid (RNA)) and a protein coat (capsid) which may additionally be covered with a lipid layer. As a result of their extraordinarily small size, viruses are only visible with the aid of electron-microscopy <sup>(78)</sup> <sup>(79)</sup> <sup>(80)</sup>.

Table 1. Selection of the biological agents potentially present in the workplace and the types of disease they may cause

Occupation/Working area	Biological agents	Possible diseases
Recycling plants for paper, glass, synthetic materials, wrapping materials	<ul style="list-style-type: none"> <li>• Moulds, especially <i>Aspergillus fumigatus</i>, <i>Actinomycetes</i></li> <li>• Gram-negative bacteria especially enterobacteria and enteroviruses</li> </ul>	<ul style="list-style-type: none"> <li>• Allergies, aspergillosis, aspergilloma</li> <li>• EAA</li> <li>• ODS</li> <li>• Infections like gastroenteritis</li> </ul>
Composting plants	<ul style="list-style-type: none"> <li>• Moulds, especially <i>Aspergillus fumigatus</i>, <i>Actinomycetes</i></li> <li>• Spore-forming bacteria</li> </ul>	<ul style="list-style-type: none"> <li>• Allergies, aspergillosis, aspergilloma</li> <li>• EAA</li> </ul>
Sewage plants	<ul style="list-style-type: none"> <li>• Bacteria, especially gram-negative bacteria (<i>Escherichia coli</i>, <i>Salmonella sp.</i>)</li> <li>• Enteroviruses and other viruses (e.g. HAV)</li> <li>• Endotoxins</li> </ul>	<ul style="list-style-type: none"> <li>• Salmonellosis and other infections like gastroenteritis, hepatitis etc.</li> <li>• ODS</li> </ul>
Food production	<ul style="list-style-type: none"> <li>• Moulds/yeasts</li> <li>• Bacteria</li> <li>• Endotoxins</li> <li>• Enzymes</li> </ul>	<ul style="list-style-type: none"> <li>• Allergies</li> <li>• ODS</li> <li>• Skin irritations</li> </ul>
Healthcare	<ul style="list-style-type: none"> <li>• Bacteria, especially infectious bacteria (e.g. <i>Legionella sp.</i>, <i>Klebsiella sp.</i>, <i>Mycobacteria sp.</i>)</li> <li>• Viruses</li> </ul>	<ul style="list-style-type: none"> <li>• Various infections which are caused by bacteria or viruses (e.g. tuberculosis, whooping cough, hepatitis, AIDS)</li> </ul>
Working areas with air conditioning systems and high humidity (e.g. textile industry, print industry and paper production)	<ul style="list-style-type: none"> <li>• Moulds</li> <li>• Bacteria (e.g. <i>Legionella sp.</i>, <i>Pseudomonas sp.</i>)</li> <li>• Endotoxins</li> </ul>	<ul style="list-style-type: none"> <li>• Bronchial asthma, SBS</li> <li>• EAA (humidifier's lung)</li> <li>• Pontiac fever, Legionnaire's disease, ODS (humidifier fever)</li> </ul>
Archives, museums, libraries	<ul style="list-style-type: none"> <li>• Moulds</li> <li>• Endotoxins</li> </ul>	<ul style="list-style-type: none"> <li>• Allergies</li> <li>• ODS</li> </ul>
Agriculture	<ul style="list-style-type: none"> <li>• Moulds</li> <li>• Dermatophytes</li> <li>• <i>Actinomycetes</i> and other bacteria</li> <li>• Viruses</li> </ul>	<ul style="list-style-type: none"> <li>• Allergies</li> <li>• Fungal skin infection</li> <li>• EAA (farmer's lung)</li> <li>• Various infections due to contact with infected animals</li> </ul>
Forestry	<ul style="list-style-type: none"> <li>• Bacteria</li> <li>• Viruses</li> </ul>	<ul style="list-style-type: none"> <li>• Borreliosis</li> <li>• Early summer meningitis</li> <li>• Rabies</li> </ul>
Horticulture	<ul style="list-style-type: none"> <li>• Moulds</li> <li>• Dermatophytes</li> <li>• <i>Actinomycetes</i> and other soil bacteria</li> </ul>	<ul style="list-style-type: none"> <li>• Allergies</li> <li>• Fungal skin infection</li> <li>• EAA</li> <li>• Tetanus</li> </ul>
Metal processing industry (use of metalworking fluids)	<ul style="list-style-type: none"> <li>• Moulds/yeasts</li> <li>• Bacteria (especially <i>Pseudomonas sp.</i>)</li> </ul>	<ul style="list-style-type: none"> <li>• Bronchial asthma</li> <li>• Contact dermatitis</li> <li>• Lung infections</li> <li>• EAA (humidifier's lung)</li> <li>• Wound infections</li> </ul>
Wood processing industry	<ul style="list-style-type: none"> <li>• Moulds</li> <li>• Gram-negative bacteria</li> <li>• Endotoxins</li> </ul>	<ul style="list-style-type: none"> <li>• Allergies</li> <li>• EAA (woodworker's lung)</li> <li>• ODS</li> </ul>
Building and construction industry (processing of natural materials like clay, straw, reed; redevelopment of buildings)	<ul style="list-style-type: none"> <li>• Moulds</li> <li>• <i>Actinomycetes</i> and other bacteria</li> <li>• Endotoxins</li> </ul>	<ul style="list-style-type: none"> <li>• Allergies</li> <li>• EAA and infections</li> <li>• ODS</li> </ul>

EAA: exogen allergic alveolitis; ODS: organic toxic dust syndrome; SBS: sick building syndrome

<sup>(78)</sup> Schlegel, H. G. (1985), *Allgemeine Mikrobiologie* 6, überarbeitete Auflage/unter Mitarbeit von Karin Schmidt, Georg Thieme Verlag, Stuttgart, New York.

<sup>(79)</sup> Deininger, C. (1993), 'Gefährdungen durch biologische Agenzien am Arbeitsplatz', *BIA-Handbuch*, 21. Lieferung X/93.

<sup>(80)</sup> Deininger, C. (1993), 'Pathogene Bakterien, Pilze und Viren am Arbeitsplatz. *Staub-, Reinhaltung der Luft* 53, pp. 293-299.

## Occurrence of biological agents

Micro-organisms have a variety of beneficial functions, such as:

- carrying out mineralisation processes that keep nutrient circles ongoing in nature;
- producing substances that are used for beverage and food production (e.g. beer, wine, yoghurt, cheese, bread, mixed pickles, etc.) or for medical care (antibiotics);
- protecting human health by being part of the natural human dermal or intestinal bacterial flora that fight pathogenic micro-organisms entering the skin surface or the digestive system.

However some of the abovementioned micro-organisms are also responsible for severe infections, allergies or toxic effects and these negative effects may also impact on employees in their working environment. Some examples of workplaces where contact with biological agents is inescapable are listed in Table 1. Summarising the contents of this table, it may be said that whenever people are in contact while working with natural or organic materials like soil, clay, plant materials (hay, straw, cotton, etc.), substances of animal origin (wool, hair, etc.), food, organic dust (e.g. paper dust), waste, wastewater, blood and other body fluids or excrements, they may be exposed to biological agents. Anyone handling these organisms in a microbiology analytical laboratory or biotechnology company is also at risk.



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## Biological agents as causative agents of diseases

Biological agents can cause three types of disease: infections, allergies, and poisoning or toxic effects. Pathogenic micro-organisms can enter the human body by penetrating damaged skin, needle stick injuries or bites, or by settling on mucous membranes. They can also be inhaled or swallowed, leading to infections of the upper respiratory tract or the digestive system.

Whether or not an infection results depends on several factors:

- the number of pathogenic micro-organisms present (infectious dose);
- the characteristics of the biological agents (ability to attach to cell surfaces, to incorporate a host and to produce or reproduce toxic substances); and
- the susceptibility of the host (general immune deficiency as a result of other infections, chemotherapy, hormone treatment, immune suppression or diseases like cancer, diabetes, etc. or local immune deficiency resulting from wounds, chemical or mechanical effects or a humid build-up of heat).

Infections may be locally limited (e.g. infections of the skin, mucous membranes, hair or nails caused by yeasts or dermatophytes) or systemic if organs like the lungs, the liver or the central nervous system are infected too.

Depending on the level of risk of infection, biological agents are classified in four risk groups <sup>(77)</sup>.

1. Group 1 biological agents means ones that are unlikely to cause human disease.
2. Group 2 biological agents means one that can cause human disease and may be a hazard to workers; they are unlikely to spread to the community; there is usually an effective prophylaxis or treatment available.
3. Group 3 biological agents means ones that can cause severe human disease and present a serious hazard to workers; they may present a risk of spreading to the community, but there is usually an effective prophylaxis or treatment available. Some of them are unlikely to be dispersed in the air.
4. Group 4 biological agent means ones that cause severe human disease and are a serious hazard to workers; they may present a high risk of spreading to the community and there is usually no effective prophylaxis or treatment available.



Table 2. Classification of micro-organisms and viruses (selection)

Organism	Risk group 1	Risk group 2	Risk group 3	Risk group 4
Bacteria	<ul style="list-style-type: none"> <li>Bacteria which are frequently isolated from soil, water or air</li> <li>Common members of the natural dermal or intestinal human microflora</li> <li>Bacterial tribes which are used in microbiological laboratories (e.g. <i>Escherichia Coli</i> K12)</li> <li>Bacterial tribes which are used for industrial purposes (e.g. <i>Lactobacillus</i> sp., <i>Bacillus anthracis</i>)</li> </ul>	<ul style="list-style-type: none"> <li><i>Clostridium tetani</i> (causative agent of tetanus)</li> <li><i>Vibrio cholerae</i> (causative agent of cholera)</li> <li><i>Escherichia Coli</i> (common member of the intestinal microflora)</li> <li><i>Salmonella enteritidis</i> (causative agent of salmonellosis)</li> <li><i>Legionella pneumophila</i> (causative agent of Pontiac fever and Legionnaires disease)</li> </ul>	<ul style="list-style-type: none"> <li><i>Mycobacterium tuberculosis</i> (causative agent of tuberculosis)</li> <li><i>Bacillus anthracis</i> (causative agent of anthrax)</li> <li><i>Chlamydia psittaci</i> (causative agent of ornithosis or parrot fever)</li> </ul>	—
Fungi	<ul style="list-style-type: none"> <li>Fungi which are frequently isolated from soil, water or air</li> <li>Common members of the natural dermal or intestinal human microflora</li> <li>Fungal tribes which are used for industrial purposes (e.g. <i>Saccharomyces cerevisiae</i>)</li> </ul>	<ul style="list-style-type: none"> <li><i>Candida albicans</i> (yeast; causative agent of e.g. intestinal or vaginal infections)</li> <li><i>Aspergillus fumigatus</i> (mould; common in soil, decaying litter or other organic materials)</li> <li>Dermatophytes (e.g. <i>Trichophyton mentagrophytes</i>)</li> </ul>	<ul style="list-style-type: none"> <li>Causative agents of severe systemic fungal infections, e.g. <i>Coccidioides immitis</i>, <i>Histoplasma capsulatum</i></li> </ul>	—
Viruses	<ul style="list-style-type: none"> <li>Life-attenuated vaccines</li> </ul>	<ul style="list-style-type: none"> <li>Hepatitis-B virus,</li> <li>Rabies virus</li> </ul>	<ul style="list-style-type: none"> <li>Herpes-B –virus</li> <li>HIV virus</li> <li>Yellow fever virus</li> </ul>	<ul style="list-style-type: none"> <li>Lassa Virus</li> <li>Causative agent of smallpox</li> </ul>

Some examples for every kind of risk group are given in Table 2 <sup>(80)</sup><sup>(81)</sup>.

Fungal, or actinomycetal, spores are important as the cause of allergies, especially if people are exposed to very high concentrations of these biological agents for longer periods. Several types of allergies are identified in immunology.

- Type I allergy symptoms appear a few minutes after a person comes into contact with the allergen (quick-type allergy). Symptoms may affect the nose (rhinitis), the eyes (conjunctivitis), the skin (urticaria) or the lungs (bronchial asthma).
- The exogen allergic alveolitis (EAA) is triggered by repeated exposure to very high concentrations (> 10<sup>5</sup> spores per m<sup>3</sup> air) of bioaerosols. Symptoms are similar to those of organic dust toxic syndrome (ODTS): spontaneous fever, shivering fits, headaches, muscle and joint pains, breathing problems, chronic cough) but, additionally, permanent damage of the lung function may be observed together with changes in the lung tissue (e.g. farmer's lung, humidifier lung).
- Type IV allergies include dermal allergies of the delayed type, for example, contact dermatitis caused by microbial exposure.

<sup>(81)</sup> Kolk, A. und C. Deininger (2000): Umgang mit biologischen Arbeitsstoffen. In: Eichendorf, W., Huf, C. A., Karsten, H., Rentel, A., Tiller, R.-E., Voß, K.-D., Weber-Falkensammer, H. und B. Zwingmann (Hrsg.): Arbeit und Gesundheit — Innovation und Prävention, Universum Verlagsanstalt, Wiesbaden, 163 — 168.



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### Toxic effects/poisonings

The organic dust toxic syndrome (ODTS) is described in literature as the result of inhalation of high concentrations of so-called endotoxins: cell-wall components of gram-negative bacteria that are set free after the decay of these organisms <sup>(79)</sup> <sup>(80)</sup>. Other bacteria produce and release so-called exotoxins, which can cause poisoning after incorporation through wound infections or



swallowing (e.g. enterotoxins which cause diarrhoea, tetanus toxin, botulinus toxin).

Mycotoxins (e.g. ergot alkaloids, aflatoxin B<sub>1</sub>, ochratoxin, etc.), which are produced by fungi and which are generally incorporated through contaminated food, can also cause severe diseases. The scientific community is still divided over whether not only oral incorporation but also inhalation of such substances can play an important role in the development of these symptoms (<sup>79</sup>).

## European legislative framework

To protect workers against risks to their health and safety from exposure to biological agents at work, the European Council issued Council Directive 90/679/EEC of 26 November 1990. This directive was amended substantially on a number of occasions over the following decade so that, for the sake of clarity and rationality, Directive 90/679/EEC and all amendments were codified in Directive 2000/54/EC of 18 September 2000, which now replaces Directive 90/679/EEC (<sup>77</sup>).

In contrast to chemical or physical hazards, the legislative framework for biological agents does not recognise occupational exposure limits. There is very little information on the 'infection doses' or 'relevant concentrations' of the biological agents that inevitably cause diseases, because it is the individual constitution of the worker that largely determines whether a person develops an illness or not.

Nevertheless, it is within the scope of the codified Directive 2000/54/EC to determine and assess the risks at the working place that are caused by biological agents. This directive should therefore be applied to any activity where workers are actually or potentially exposed to biological agents as a result of their work. If the activity is likely to involve a risk of exposure to biological agents, then the nature, degree and duration of exposure has to be determined in order to assess the risk to the workers' health or safety and determine the measures to be taken.

If workers are exposed to several groups of biological agents, then the risk must be assessed in terms of the dangers posed by all the hazardous biological agents present (information about the classification of biological agents is given in Annex III of the directive). This risk assessment must be renewed regularly and in any case when working conditions change in a way that affects the workers' exposure to such biological agents. Risk assessment shall be based on all the available information on:

- the classification of biological agents which are or may be a hazard to human health while working;
- the information on diseases which may be contracted as a result of worker activity;
- the information on potential allergenic or toxigenic effects as a result of worker activity, etc.

If the results of such an assessment show that the actual or potential exposure is to Group 1 biological agents only, without any identifiable health risk to workers, then it is sufficient to observe the principles of good occupational safety and hygiene. It is also essential to determine whether the activity in question involves a deliberate intention to work with a biological agent (e.g. work in microbiology diagnostic laboratories or biotechnology enterprises) or whether the worker's exposure to biological agents is an inevitable consequence of his work (e.g. as in agriculture, food production, healthcare, refuse disposal plants, sewage purification installations, etc.).

The main principles of Directive 2000/54/EC are the replacement of harmful biological agents whenever possible by less dangerous micro-organisms, and the prevention or reduction of risks by the introduction of technical and organisational measures or, ultimately,

by the use of PPE for individual protection if necessary. Common rules of hygiene should be applied and the diffusion of bioaerosols in working environments should be avoided. Laboratory coats, gloves and, if necessary, masks over the mouth should be used in order to avoid personal contact with biological agents, and disinfection and sterilisation procedures should be applied. Vaccination can also be a preventive measure in special cases to avoid virus infections.

Directive 2000/54/EC also stipulates that workers must be informed and trained appropriately on the job and advises on the administrative procedures to be observed in the event of a risk assessment showing that the actual or potential exposure while working relates to micro-organisms belonging to risk groups 2 to 4.

Recommendations are also made on health surveillance but, ultimately, it is up to the Member States of the European Union to take the appropriate measures, in line with national laws and practice, regarding those workers identified by risk assessments as being at risk from exposure to biological agents. Particular attention is given to those health and veterinary care facilities that are not diagnostic laboratories, and special measures are stipulated for industrial processes, laboratories and animal rooms.



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## Outlook

The life sciences try to apply the infectious potential of micro-organisms (e.g. viruses which normally cause influenza) to the task of developing effective tools against various diseases by the use of gene-therapy. The biotechnology industries use the enormous metabolic potential of biological agents for the production of many components of our daily life, for example, citric acid for food production and detergents, enzymes, pigments, antibiotics and so forth.

Without micro-organisms in the soil to release carbon dioxide to the atmosphere through breathing and mineralisation of organic matter, the carbon dioxide stock of the atmosphere would be quickly exhausted by the photosynthesis mechanism of plant life.

These examples show that biological agents are of increasing interest to research and industry, and that they are an indispensable part of our natural environment. Contrasted with these promising benefits of microbial life and activities, frightening reports of the negative effects of biological agents have also appeared in the media in the last two to

three years: animal diseases like bovine spongiform encephalopathy (BSE), or foot-and-mouth disease, which has had a disastrous impact on consumer confidence and the livestock industry, and acts of bioterrorism in which micro-organisms (e.g. special laboratory tribes of *Bacillus anthracis*) have been used selectively to infect people with severe diseases.

People generally, and workers who are unintentionally exposed to biological agents in particular, often know little about micro-organisms, their optimal living conditions, and their beneficial or harmful characteristics. This may have a lot to do with the fact that they are not visible to the naked eye, but only with optical instruments. People need to be better informed, both to free them from the fear of the unknown and to make them better aware of the biological hazards.

To this end, we need to acquaint them with:

- the ecological demands of micro-organisms, so that we all get a better understanding of whether we are likely to be exposed or not to micro-organisms when working (especially if the contact with biological agents is due to unintentional use of them);
- the beneficial effects of biological agents (to have a better understanding of the 'invisibles') as well as about the diseases they can cause; and
- simple protection measures like general rules of hygiene and simple technical or organisational procedures (e.g. vacuuming rather than sweeping, moist cleaning rather than dry cleaning) to minimise the formation and release of bioaerosols.

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