Occup Environ Med 2001;**58**:138–144

OCCUPATIONAL EXPOSURE LIMITS FOR CHEMICALS

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- **Occupational exposure limits (OELs) are tools to help employers protect the health of those who may be exposed to chemicals in their workplace. Under the United Kingdom Control of Substances Hazardous to Health (COSHH) Regulations they define adequate control by inhalation.**
- **OELs are set by the Health and Safety Commission (HSC) on advice from its Advisory Committee on Toxic Substances (ACTS) and after public consultation. Thus they are consensus limits which have the support of both sides of industry.**
- **COSHH uses two types of occupational exposure limit—the occupational exposure standard (OES) and the maximum exposure limit (MEL).**
- **OESs are set for substances for which it is possible to identify a concentration at which there is no significant risk to health. Employers are required to meet the limit, there is no requirement to go below it, and it can be exceeded provided steps are taken to meet it as soon as reasonably practicable.**
- **MELs are set for substances which have serious health implications and for which an OES cannot be set. Most of the substances with MELs are either carcinogens or causes of occupational asthma. Employers must not exceed an MEL and must reduce exposure as far below it as is reasonably practicable.**
- **MELs are set at concentrations achievable by good occupational hygiene practice such that risks to workers are judged to be reduced to a tolerable level. The HSC consider that this approach is preferable to the use of mathematical models to generate risk estimates, which inevitably gives a spurious appearance of accuracy.**
- **The MEL/OES system is poorly understand by many employers who use chemicals, is not comprehensive as some substances meet neither the OES nor MEL criteria, and does not mesh well with indicative occupational exposure limit values which will increasingly be set under the European Union Chemical Agents Directive.**
- ***COSHH essentials: easy steps to control chemicals* provides the practical help that firms need to control chemicals. It takes users straight from hazard and exposure considerations to benchmark standards of good practice.**
- **The problems with the current system have prompted ACTS to set up a subgroup to review the OEL framework.**

INTRODUCTION

The manufacture and use of chemicals has brought innumerable benefits to modern society. But, like fire, chemicals are good servants but bad masters. Some pose a threat to safety from fire or explosion, others have the potential to harm the environment, and most can harm human health. The effects can vary from mild irritation of the airways occurring at high doses to cancer from exposure to tiny quantities. The challenge is to use chemicals to maximum social and economic benefit while protecting workers and the public. Occupational exposure limits (OELs) are an important tool for achieving health protection.

In Great Britain airborne standards for the workplace were established for a few substances such as cotton dust and asbestos back in the 1930s, but the history of systemic setting of OELs began when the American Conference of Governmental Industrial Hygienists (ACGIH) published the first list of OELs, known as threshold limit values (TLVs), in 1948. Subsequently the list has been updated annually. The United Kingdom, in common with many industrialised countries, adopted this list. It formed the backbone of United Kingdom limits until the Health and Safety Commission's limit setting procedure was established in 1984 and even now many United Kingdom limits remain which were taken from the 1980 TLV list, the last time it was published by the United Kingdom.

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The ACGIH introductory text[1] explains that TLVs are intended for use in the practice of industrial hygiene as guidelines or recommendations in the control of potential workplace health hazards. They are not fine lines between safe and dangerous concentrations and although serious adverse health effects are not thought to be likely as a result of exposure at the TLV, the best practice is to maintain concentrations as low as practical. The text emphasises that TLVs should not be used by anyone untrained in the discipline of industrial hygiene. They are set by an expert committee established by the ACGIH and are issued by the ACGIH, they do not have any legal status.

Occupational exposure limits are important features of the Control of Substances Hazardous to Health (COSHH) Regulations. These regulations, made under the Health and Safety at Work Act, provide a useful tool of good management setting out seven basic measures that employers must take to protect both employees and others who may be exposed. They are summarised in a free booklet *COSHH: a brief guide to the regulations*.[2] At the heart of COSHH is the requirement that employers prevent their employees from being exposed to hazardous substances or where this is not reasonably practicable, then they ensure that exposure is adequately controlled. This will involve considering whether employees can inhale the substance or come into skin contact with it. The OELs define adequate control by inhalation and provide consistent standards across industry. They have been set for around 600 of the several thousand chemicals in regular use. Thus the COSHH Regulations moved OELs from being tools for occupational health and safety professionals to legal limits which all employers have to understand and apply.

The two types of OEL: OES and MEL

COSHH uses two types of occupational exposure limit—the occupational exposure standard (OES) and the maximum exposure limit (MEL). Both are expressed as airborne concentrations averaged over a period, either a long term exposure limit (8 hour time weighted average (TWA)) or a short term exposure limit (15 minute reference period). The short term exposure limits are used for substances for which short term peaks of exposure could result in serious health effects—for example, respiratory irritants such as chlorine.

The OESs are set for substances for which it is possible to identify, with reasonable certainty, a concentration of exposure at which it is judged that there is no significant risk to health and with which compliance by industry is reasonably practicable. Where such a concentration cannot be identified and the chemical has serious health implications for workers, then an MEL is considered. Employers have different responsibilities in relation to the two types of limit. The OES is considered to be a "safe" concentration and employers are required to meet the standard. They do not have to go below it and it is permissible to exceed it provided the employer takes appropriate action to remedy the situation as soon as is reasonably practicable. By contrast, for the MEL exposure is only considered adequate if it is reduced so far as is reasonably practicable and in any case below the MEL. These duties are set out in box 1.

Two types of limit are used to reflect the two profiles, in broad terms, of dose response relations for the toxic effects of chemicals. These are represented schematically in figure 1. A substances is considered for an OES if a concentration can be identified at which it is judged that there is no concern to human health. Thus a no observed adverse effect level (NOAEL) has to be identified from the available information, often data from studies carried out on experimental animals,

Box 1: Duties associated with OESs and MELs

OES	MEL
Standard must be met	Limit must be met
No requirement to further reduce exposure	Exposure must be reduced below the limit so far as is reasonably practicable
Standard can be exceeded providing steps are taken to meet it as soon as reasonably practicable	Limit must not be exceeded

to which an "uncertainty" factor is applied to take account, as appropriate, of:

- uncertainties in applying the data
  - extrapolation from animals to humans
  - individual variation within the human population
- uncertainties in the data
- the nature of the adverse effect.

The uncertainty factors used in setting OESs have been reviewed by Fairhurst.[3]

Having arrived at a putative OES two other factors have to be considered. As employers are allowed to exceed OESs, excursions above the limit which could occur in practice have to be unlikely to produce serious effects on health and finally compliance has to be reasonably practicable. There is no point in setting a limit at a level that industry cannot comply with. In these circumstances an MEL is considered. The criteria for setting OESs and MELs are given in box 2. The rationale for a typical OES is given in box 3.

There are two main groups of substances for which an NOAEL cannot be identified, respiratory sensitisers and genotoxic carcinogens. For respiratory sensitisers the paucity of data on dose-response relations which typically exists means that it is not possible to identify with reasonable certainty a concentration at which workers will not become sensitised.

For genotoxic carcinogens the United Kingdom Committee on Carcinogenicity of Chemicals in Food, Consumer Products, and the Environment have concluded in their guidelines for the evaluation of chemicals for carcinogenicity.[4]

> "It is prudent to assume that genotoxic carcinogens have the potential to damage DNA at any level of exposure and that such damage may lead to tumour development. Thus for genotoxic carcinogens it is assumed that there is no discernible threshold and that any level of exposure carries a carcinogenic risk."

This view is also reflected in the European Union Carcinogens Directive which requires exposure to be reduced in so far as is technically possible for substances which in Annex

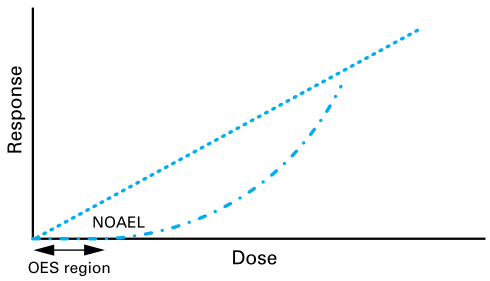

Figure 1 Schematic representation of dose-response relations for toxic chemicals: – – – – candidates for OESs; ····· candidates for MELs. Response may be increasing severity of toxic effects or an increasing proportion of the exposed population affected, or both.

Box 2 Indicative criteria for setting OESs and MELs

OES

For a substance to be assigned an OES it must meet **all** the following three criteria:

Criterion 1 The available scientific evidence allows for the identification, with reasonable certainty, of concentrations averaged over a reference period, at which there is no indication that the substance is likely to be injurious to employees if they are exposed by inhalation day after day to that concentration;

Criterion 2 Exposure to concentrations higher than that derived under criterion 1 and which could reasonably occur in practice, are unlikely to produce serious short or long term effects on health over the period that it might reasonably take to identify and remedy the cause of excessive exposure;

Criterion 3 The available evidence indicates that compliance with the OES, as derived under criterion 1, is reasonably practicable.

MEL

For a substance to be assigned an MEL it must meet **either** of the following criteria:

Criterion 4 The available evidence on the substance does not satisfy criterion 1, or 2, or both for an OES and exposure to the substance has, or is liable to have, serious health implications for workers; or

Criterion 5 Socioeconomic factors indicate that although the substance meets criteria 1 and 2 for an OES, a numerically higher value is necessary if the controls associated with certain uses are to be regarded as reasonably practicable.

Box 3 Basis for the OES for dimethylaminoethanol (DMAE)

The only clear evidence for health effects induced by dimethylaminoethanol (DMAE) in humans are in single case reports of asthma and non-specific respiratory tract irritation. These do not provide sufficient information to conclude that DMAE has the potential to cause respiratory sensitisation. There are no data to indicate that DMAE is genotoxic. Irritation of the mucous membranes of the eyes and upper respiratory tract was found in single and repeated inhalation exposure studies in animals exposed to DMAE vapour and it can be concluded that the main health effect is non-specific irritation of the respiratory tract.

There is no information in the case reports on exposure concentrations producing irritation. A no observed adverse effect level (NOAEL) of 8 ppm was identified in a 90 day repeated inhalation study in rats, based on the absence of clinical signs; histology was not carried out at this exposure concentration. Allowing for the lack of information on the irritancy of DMAE in humans and the absence of histological examination in rats at 8 ppm, an OES of 2 ppm (8 hour TWA) was set.

Short term peak exposures of 8–16 ppm (15 minute reference period) have been estimated during tanker loading. To control such exposures a short term OES (15 minute reference period) was set at 6 ppm.

1 to the Directive 67/548/EEC the risk phrase R45 "may cause cancer" is applied. This stance carries with it the assumption that the dose-response line in figure 1 extrapolates through zero, although the shape and slope of the line may not be known.

As it follows that it is not possible to establish a "safe" concentration how are the values of MELs to be derived? The aim is to maximise the protection of workers' health, by setting MELs as low as reasonably practicable. Thus they are set at concentrations which can be achieved by good occupational hygiene practice such that the risks to workers are judged to be reduced to a tolerable level.

Who sets OELs?

Sometimes OESs and MELs are incorrectly referred to as Health and Safety Executive (HSE) limits. They are, in fact, the Health and Safety Commission (HSC) limits and therefore have tripartite consensus and endorsement. The HSC, its Advisory Committee on Toxic Substances (ACTS), and a subgroup of ACTS, the Working Group on Assessment of Toxic Chemicals (WATCH), are all involved in setting OELs. Interests represented on ACTS are given in box 4. The WATCH membership has a similar range of interests. The difference between the committees is that ACTS members reflect the views of the constituents that they represent, whereas WATCH is a technical committee and members are chosen on the basis of their personal expertise.

Box 4 Interests represented on the Health and Safety Commission's Advisory Committee on Toxic Substances (ACTS)*

Employees	Four TUC nominees
Employers	Four CBI nominees
Local authorities	Two local government authority nominees
Environmental interests	One representative: selected by HSE
Consumers	One representative: selected by HSE
Independent experts	Five representatives: selected by HSE

*The committee is chaired by the Director of the Health Directorate of the HSE, and HSE provide the secretariat.

The limit setting process is set out in figure 2. Firstly WATCH considers a package of information on a chemical. If the committee consider that it meets the criteria for an OES, they will recommend a value to ACTS. If it does not, they will refer the substance to ACTS for further consideration, normally the setting of an MEL. The ACTS considers proposals for OESs, if the WATCH recommendations are agreed, the proposals are subject to public consultation. Proposals are published in an HSC consultation document which sets out the physicochemical properties of the chemical, a summary of the available toxicological data, information on exposure, and the basis for the limit. This is automatically sent to a wide range of interested parties and a press release issued. The consultation document is available free from HSE Books (PO Box 1999, Sudbury, Suffolk, CO10 2WA, UK) or can be downloaded from web site of the HSE (www.hse.gov.uk\condocs\). Finally, and subject to consultation, the HSC is invited formally to endorse the proposals which are then published in *EH 40, occupational exposure limits*.[5] The information in the consultative document is published in an annual supplement to *EH 64 summary criteria for OELs*.[6]

If ACTS agrees that an MEL is appropriate, the HSE is normally asked to issue a chemical hazard alert notice (CHAN), to inform industry that there are serious health hazards associated with the chemical. These are issued because it may take some time to establish an MEL and clearly it is important to inform industry of health risks. If only a few workers are exposed to the chemical, ACTS may consider the resources needed to set an MEL are not justifiable and employers are expected to establish suitable control regimes on the basis of the information in the CHAN.

If ACTS decide to set an MEL, the HSE will gather the information on good occupational practice relative to the use of the chemical and make proposals for an MEL. A regulatory impact assessment is prepared for each MEL proposal which sets out the socioeconomic factors of balancing risks to health against the costs and effort of reducing exposure. Proposals for the MELs are considered by ACTS, HSC consults on them and then decides whether to endorse them. These, like OESs, are published in *EH 40, occupational expo-*

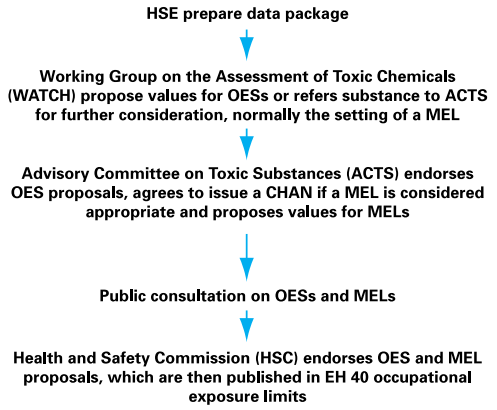

Figure 2 Summary of the occupational exposure limit setting process.

sure limits. From the first consideration of a substance by WATCH to the implementation of the MEL typically takes 3–5 years.

Tolerability of risk framework

The HSE's tolerability of risk framework (fig 3) can be used to show the relation between the two types of limit and how employers' duties under the limits (box 1) relate to the two types of toxicity profile (fig 1). Figure 3 shows that MELs are at the upper boundary of the tolerability, whereas OESs are intended to represent negligible risk. As MELs are set for chemicals for which a no adverse level cannot or has not been identified, then it follows that there is a measure of risk at the limit. Therefore, once a concentration that can be achieved by good occupational hygiene practice has been identified it is intolerable to expose workers to a higher concentration—greater risk. Hence the requirement that MELs must not be exceeded. Furthermore, exposure should be reduced so far as is reasonably practicable below the MEL, as the residual risk is only tolerable if further risk reduction is impracticable or requires action that is grossly disproportionate in time, cost, and effort.

By contrast OESs are derived from NOAELs and are intended to be negligible risks, therefore resources needed to reduce risk further are likely to be grossly disproportionate to the reduction in risk achieved. Hence there is no requirement on employers to reduce exposures below the limit. Furthermore, excursions into the tolerable region are acceptable providing that steps are taken to remedy the situation as soon as is reasonably practicable.

Quantative assessment of risk

The tolerability of risk framework was originally developed for the nuclear industry. In this context the upper level of tolerability of risk of death to any worker was considered, after public consultation, to be 1/1000/year and the negligible risk level to be 1/1 000 000. These values cannot be applied to consideration of health risks as:

- Many of the health effects are not fatal—for example, occupational asthma can be severely disabling and have a profound effect on a person's quality of life, but it rarely kills
- Quantitative dose-response data are rarely available.

Quantitative dose-response data are available for some genotoxic carcinogens from standard carcinogenicity studies carried out in rodents. Several mathematical models are available which have been used, particularly by some regulatory authorities, to generate numerical estimates of carcinogenic risk at low doses. These models make assumptions about the mechanism of action of the chemical in the initiation of tumours. But there are normally no data to allow the selection of a particular model on the basis of biological relevance. Depending on the model fitted to the dose-response data, estimates of risk at doses below the experimental data may vary by up to four orders of magnitude.

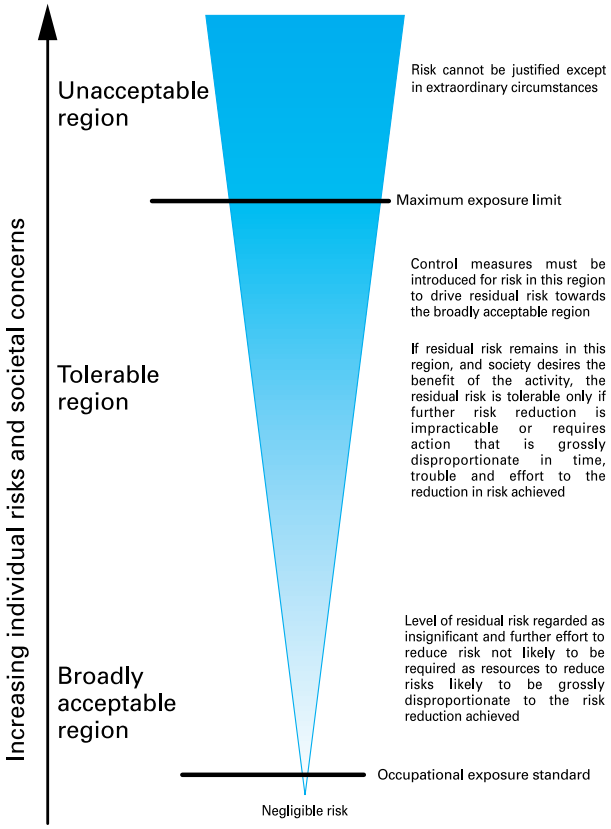

Figure 3 How OELs fit into the HSE's tolerability of risk framework.

In considering the use of these models the United Kingdom Committee on Carcinogenicity of Chemicals in Food, Consumer Products, and the Environment have concluded in their guidelines for the evaluation of chemicals for carcinogenicity:

> "These models may give an impression of precision which cannot be justified from the approximations and assumptions upon which they are based. They are less persuasive than the broadly based approach to assessing putative carcinogens adopted by the Committee on Carcinogenicity which uses all the available data and which draws on expertise and information from a wide range of medical and scientific opinion."

The HSC has taken essentially the same approach and considers that using the judgement and expertise of its tripartite committees is the optimum way to set demanding, but realistic, OELs for the control of carcinogens. Enforceable, consensus limits which have the support of both sides of industry are infinitely preferable to risk estimates with their spurious appearance of accuracy.

Difficulties with the current system

Criteria for setting OESs AND MELs

The WATCH, the first HSC committee to examine a data package, has to make the decision about whether an OES is appropriate for the substance under consideration. In apply-

ing the criteria (box 2), WATCH has taken the view that the first one is only met if the committee considers that a "safe" concentration can be identified from the available information. Thus for substances with a limited or poor quality dataset the committee has increasingly had difficulty in identifying with any certainty a concentration judged to be of no concern to human health. However, not all such substances have serious health implications for workers, (one of the criteria for setting an MEL). Thus there is a gap between the OES and MEL criteria into which an increasing number of substances fall.

For example, WATCH recently concluded that the OES criteria were not met for napththalene on the basis of data from animal tests. These showed that nasal damage occurred at very low concentrations although the committee was uncertain whether this effect was relevant to humans, as specific metabolic processes were involved which may not occur in humans. However, the health effects were not serious enough to meet the first criteria for an MEL.

Application of OELs by small and medium sized firms

Larger chemical companies and health and safety professionals have no difficulty with the requirements of COSHH to assess risks from chemicals, decide on suitable control measures, and implement and monitor them. But what about the many thousands of smaller firms which use chemicals? A survey that the Health and Safety Commission carried out showed that many small firms wanted to be told exactly what they need, and do not need, to do. To explore the knowledge of small firms about controlling chemicals, the HSE carried out market research to find how firms decide what controls to use and to measure their understanding of the COSHH Regulations and OELs.[7] Managers responsible for health and safety were interviewed at 1000 firms which use chemicals, 400 interviews were with firms engaged in occupations which would involve some exposure to chemicals (all user group) and 600 with firms in which chemicals were in daily use (heavy user group). The profile of respondents reflected that of United Kingdom industry in that most respondents (75% from all user group and 57% from heavy user group) were from firms with 10 employees or less. A smaller survey was also carried out with 150 Trade Union representatives.

The results of the survey were encouraging in that most chemical users are taking steps to control their employees' exposure, although, of course, we had no information on the suitability of the controls used. This suggests that any failure properly to control chemical exposure arises from a lack of knowledge, rather than an unwillingness to protect employees' health.

However, the respondents' knowledge of COSHH and OELs was very limited. When respondents were asked what legal requirements exist for establishments which manufacture or work with chemicals only 16% of the all user group and 30% of the heavy user group mentioned complying with either COSHH or OELs. Although around two of three respondents claimed to understand the term occupational exposure limit, only 12% of the all user group and 28% of the heavy user group mentioned monitoring (either regular or when necessary) when asked how they would assess whether an OEL was being met. Awareness of the different duties associated with OESs and MELs and of the two reference periods, the 8 hour TWA, and 15 minute reference period was vanishingly small among the all user group (fig 4). The Trade Union representatives had slightly greater understanding of OELs than the managers in these small firms.

Thus it is apparent that OELs play little part in the decisions that these firms make on the management of risks from

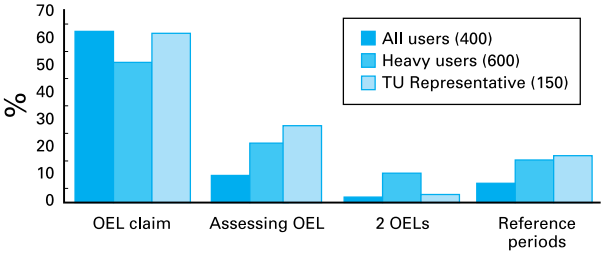

Figure 4 Knowledge of OELs among 1000 randomly selected chemical users. All users use chemicals in their workplace on occasions; heavy users use chemicals daily; TU reps=Trade Union representatives randomly selected from addresses supplied by union headquarters. OEL claim=respondents claiming to be aware of OELs; assessing OEL=respondents showing awareness of how to assess whether an OEL is being met; 2 OELs=respondents aware of the two types of OEL; OES and MEL; Ref period=respondents aware of the two references periods—8 hour TWA and 15 minute reference period.

chemicals. It follows that moving OELs from tools for health and safety professionals to limits with which all chemical users have to comply has not been a success.

A new approach: *COSHH essentials: easy steps to control chemicals*

To provide the practical help that firms need—clear advice on appropriate control approach to protect the health of their employees—the HSE set up a working group of key stakeholders. The group developed a simple system of generic risk assessments which leads to the selection of an appropriate control approach.[8] From the control approach, for several common unit operations—for example, mixing, filling, weighing—the user can select an appropriate control guidance sheet. This provides examples of good practice and gives basic descriptions of the type of control needed and factors to consider. The purpose of the scheme is to take users straight from hazard and considerations of exposure potential to benchmarks of generally accepted industry standards of good practice. This new approach *COSHH essentials*: *easy steps to control chemicals*[9] was published in May 1999.

OELs and the European Union

During the past decade the European Union has established its own procedure for setting OELs. A Scientific Committee on Occupational Exposure Limits (SCOEL) has the remit to make recommendations for OELs for inhalation exposure, based solely on current scientific evidence, such that exposure repeated for 8 hours a day, 5 days a week over a working lifetime will not result in adverse effects to workers or their progeny. Members of SCOEL are scientific experts nominated by member states for their expertise, they do not represent national positions. To guide their deliberations SCOEL has developed a series of key documents which set out the general principles and approaches taken by SCOEL in dealing with setting OELs. These have been summarised in *Methodology for the derivation of occupational exposure limits*.[10]

This document defines European Union OELs as broadly falling into two categories:

- "Health based" OELs: where the total available scientific data base leads to the conclusion that it is possible to identify a clear threshold dose below which exposure to the substance in question is not likely to lead to adverse health effects. These become indicative occupational exposure limit values (IOELVs).
- "Pragmatic" OELs: where for some adverse effects—for example, genotoxicity, carcinogenicity, and respiratory

Comparison of OELs for six solvents in different European Union member states (ppm, 8 h TWAs)

Substance	*UK: OES*	*Germany: MAK*	*Sweden*	*Netherlands*
Xylene	100	100	50	50
Trimethyl benzenes	25		25	20
n-Hexane	20	50	25	25
Ethyl ether	400	400	400	100
Toluene	50	50	50	40
Perchloroethylene	50		10	35

MAK=Maximale Arbeitsplatz Konzentration.

sensitisers—it is not possible on present knowledge to define a threshold of activity and therefore any level of exposure represents a risk. These become binding limit values (BLVs).

So far only one BLV has been set, for inorganic lead and its compounds, all the other European Union OELs are considered by SCOEL to be health based and are therefore IOELVs. The BLVs can also be set for carcinogens, by amendment to the Carcinogens Directive; so far one limit has been set, for benzene.

Summaries of the SCOEL proposals for each substance are made available to government officials in member states of the European Union, industry, and workers' representatives for comment on the scientific rationale for the limit proposal. The SCOEL considers any comments received, then the proposals go forward to a tripartite group of government, employer, and employee representatives, which consider issues of feasibility. Finally the proposals go the Commission for inclusion in an Indicative Limit Value Directive, (since 1999 an Indicative Occupational Exposure Limit Value Directive). The proposal for Commission Directive is put formally to a committee of member state representatives (often referred to as a Technical Progress Committee (TPC)) which acts by qualified majority voting to adopt the limit proposals in the proposed Directive.

There were two European Union Indicative Limit Value Directives, which between them contained indicative limit values (ILVs) for 50 substances. The Directives required member states to consider ILVs in setting national limits, but there was no obligation to set a limit. However, the adoption of the Chemical Agents Directive changed all this. Under this Directive there is an IOELV Directive. The IOELV Directive requires member states to set a limit for all substances in the Directive, taking account of the IOELV.

The first IOELV Directive must be implemented by December 2001 and contains limits for 63 substances including some, but not all, of the substances in the ILV Directives. Many IOELV proposals meet the criteria for an OES, however, for a few substances WATCH consider that criterion 1 for an OES is not met (box 2). Thus although SCOEL had concluded that a health based limit could be set, WATCH did not agree, as a consequence an MEL will have to be considered for these substances. A further IOELV Directive is in the pipeline, and it is expected that more will emerge on an ongoing basis, so there is a need to develop a limit system for the United Kingdom which will readily incorporate IOELVs.

OELs in other European Union states

Procedures for establishing OELs are in place in several European Union member states. The table gives the OELs that have been set for six common solvents in the United Kingdom, Germany, Sweden, and The Netherlands. Although the values are all in the same order of magnitude, there are differences between the numerical values chosen. The establishment of an European Union limit setting procedure will lead to harmonised limits throughout the European Union and save resources as it will no longer be necessary for expert committees in each member state to pore over the same data and come up with slightly different limits.

Conclusions

Since their introduction 50 years ago, OELs have been valuable tools for occupational hygienists responsible for implementing and monitoring workplace controls on chemicals. There is no doubt they will continue to be so. However, there have been other major changes which suggest the need to look at the role of OELs. There is now an agreed European Union chemical hazard classification system, with the possibility of a globally harmonised system on the horizon; a rapid growth in electronic information storage and retrieval systems means that more information can be made readily available, and workers have different expectations relative to protection against risks to health. These changes and the problems with the current system have promoted ACTS to set up a subgroup to review the OEL framework. The subgroup will be considering how OELs can be developed to provide a robust system for the 21st century, which will effectively contribute to the management of chemicals in the workplace.

References

1 ***1999 TLVs and BEIs: threshold limit values for chemical substances and physical agents and biological exposure indices***. Cinncinnati, Ohio: American Conference of Governmental Industrial Hygienists, 1999. (ISBN 1–882417–32–1.)

2 ***COSHH: a brief guide to the regulations***. London: HSE Books, 1999. (ISBN 0–7176–2444–7.)

► **This booklet outlines for employers in simple terms what they need to know about the Control of Substances hazardous to Health Regulations 1999 (COSHH). It sets OELs in the framework of the actions required under the COSHH regulations and is of interest to safety representatives, health and safety professionals and anyone interested in health and safety issues.**

3 **Fairhurst S**. The uncertainty factor in the setting of occupational exposure standards. *Ann Occup Hyg* 1995;**39**:375–85.

► **This paper explains how the uncertainty factors used in setting OESs are derived, using case studies as examples.**

4 ***Guidelines for the evaluation of chemicals for carcinogenicity***. London: The Stationery Office, 1991. (ISBN 0–11–321453–7.)

5 ***Occupational exposure limits EH 40/2000*** (revised annually). London: HSE books, 2000. (ISBN 0–7176–1660–6.)

► **This publication contains the list of maximum exposure limits and occupational exposure standards for use with the COSHH regulations. It also provides information on how to apply OELs, how they are set, and their scope.**

6 ***Summary criteria for occupational exposure limits EH 64.*** London: HSE Books, 1996. (ISBN 0–7176–1085–3.) *Criteria document summaries EH 64*. 1997 Supplement. (ISBN 0–7176–1364-X.) 1998 Supplement. (ISBN 0–7176–1576–6.) 1999 Supplement. (ISBN 0–7176–2451-X.)

7 **Topping MD**, Williams CR, Devine JM. Industry's perception and use of occupational exposure limits. *Ann Occup Hyg* 1998:**42**:357–66.

► **A 1000 randomly selected chemical users were interviewed to determine how they obtained information on the harmful properties of chemicals they were using, how they decided what control measures to use, and to assess the extent of their knowledge about the COSHH Regulations and OELs.**

8 **Russell RM**, Maidment SC, Brooke I, *et al*. An introduction to a UK scheme to help small firms control health risks from chemicals. *Ann Occup Hyg* 1998;**42**:367–76.

9 ***COSHH essentials: easy steps to control chemicals***. London: HSE Books, 1999. (ISBN 0–7176–2421–8.)

10 ***Methodology for the derivation of occupational exposure limits: key documentation***. Luxembourg: European Commission, 1999. (Report EUR 19253 EN. ISBN 92–828–8106–7.)

QUESTIONS (See answers on page 118)

(1) Which of the following statements about MELs and OESs are true?
- (a) MELs are only set for the nastiest substances
- (b) MELs are ceiling values which must not be exceeded, even for a few minutes
- (c) Provided that employers are complying with an OES, the COSHH Regulations do not require them to do anything else
- (d) OESs and MELs represent adequate control by inhalation
- (e) An employer can be prosecuted under the COSHH regulations although exposure is below an MEL

(2) Which of the following statements are true? For an OES to be set:
- (a) Defined criteria must be met
- (b) Data from workers must show it is a safe level
- (c) Dose-response data need to be available to work out effects at different doses.
- (d) A no adverse effect level must be identified
- (e) Exposure data showing that industry can reasonably comply with the OES need to be available

(3) Which of the following statements are true?
- (a) OELs are set by civil servants
- (b) OELs will increasingly be influenced by EU Directives
- (c) All the information on which OELs are based is publicly available
- (d) The HSC sets OELs after public consultation
- (e) OELs have been set for over 1500 chemicals

(4) Which of the following statements about MELs are true?
- (a) MELs are set at a defined level of risk to workers' health
- (b) MELs take account of risks to health and the costs and effort of reducing exposure
- (c) MELs are always set for genotoxic carcinogens because:
  - (1) They are nasty chemicals
  - (2) A level at which there is no risk cannot be identified
- (d) MELs are set at a level of control that can be achieved by:
  - (1) The very best control technology available
  - (2) The application of good occupational hygiene practice
- (e) Workers exposed at MEL values may suffer ill health as a result

(5) Which of the following statements are true?
- (a) A survey showed that small firms:
  - (1) Couldn't care about protecting employee health
  - (2) Were largely unaware of OELs
  - (3) Wanted to be told what controls to use
- (b) To help small firms, HSE has developed lengthy, prescriptive guidance which tells them exactly what to do in each situation.
- (c) *COSHH Essentials*, a simple step by step approach to assessing and controlling risks from chemicals has been developed on a tripartite basis