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CONTROL BANDING- A PRACTICAL APPROACH TO JUDGING CONTROL METHODS FOR CHEMICALS

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Abstract There is widespread concern over the risks, real or feared, from the rapidly increasing inventory of chemicals in commercial use. Many users of chemicals rely for their information on their supplier and safety data sheets (SDS). These summaries of properties are difficult for the average user to convert into practical control action. It is possible to take the classification data (the Risk Phrases) which are globally harmonised and link these directly to control advice given a knowledge of the process and purpose of the chemical - information immediately available to many. A level of control can be introduced, which although lacking the specific assurance of a professional hygiene and toxicological assessment does present sensible action. This approach has received widespread support by employers, workers and professional hygienists in the UK, and is now being taken forward in other countries, through the European Commission, and globally through ILO.

Key words: control banding, safety data sheets, Risk Phrases, Occupational exposure limits

Rezumat Există o îngrijorare generală referitoare la riscul, real sau închipuit, ce apare datorită creşterii numărului de substanţe chimice aflate în circuitul comercial. Mulţi utilizatori de substanţe chimice se sprijină pe informaţii puse la dispoziţie de furnizori sau desprinse din fişele toxicologice (SDS) ce însoţesc produsul. Aceste date în rezumat sunt dificil de convertit în măsuri regulatorii practice. Există posibilitatea ca să se pornească de la datele de clasificare (Frazele de Risc), care sunt armonizate pe plan global şi să se facă o corespondenţă directă cu măsurile de protecţie specifice necesare utilizării unei substanţe chimice într-un scop dat - informaţie aflată la îndemâna oricui. Se poate astfel introduce un sistem de măsuri regulatorii, care deşi nu prezintă siguranţa evaluării igienice şi toxicologice, are o acţiune considerabilă. Acest mod de abordare se bucură de un sprijin larg în rândul patronatului, muncitorilor şi igieniştilor din Marea Britanie şi în prezent este promovat şi în alte ţări prin intermediul Comisiei Europene şi prin Organizaţia Internaţională a Muncii (ILO).

Cuvinte cheie: măsuri regulatorii, fişe toxicologice, Fraze de Risc, Limite de expunere profesională

INTRODUCTION

Occupational Exposure Limits (OELs) have long been a valuable means of guiding control decisions for industrial chemicals. They have been developed for many hundreds of substances and have a high level of acceptance within professional circles. Their value in

preventing the harmful effects of agents such as silica and lead is well established. Practical limits, based on good science will continue to play an important part in protecting the health of workers.

The development of OELs should not be pursued uncritically, and there are many costs and disadvantages in relying upon the setting of a standard as a primary determinant of action. There is now much activity worldwide in developing alternative approaches that in some cases will supplement the OEL route, in particular in leading to practical interventions which overall will provide a greater return on scarce resource. This paper explores some of the issues and outlines one approach- that of control banding - that offers advantages.

Some of the problems with OELs

After more than 60 years of diligent and skilled professional activity within professional bodies and governments there are probably much less than 1000 substances that have specific OELs. Many of these limits are derived by analogy and on very limited toxicological information. They are judgements based on the available data but certainly lack assurance. The underpinning scientific studies, including human epidemiology, that provide a firm basis for setting a very few limits are not available for the very great majority. The cost of acquiring such evidence; the practical difficulties of establishing a study population; the other uses to which the resources could be devoted and indeed the absence of clearly identified harm together ensure that OELs will remain, for the most part, imprecise indicators of risk and will continue to require the skilled assessment of hygienists if they are to be properly used. Efforts are underway internationally through the chemical industries, OECD and within the European Union to build up the information base on priority, high tonnage substances but this is a slow process when compared with the pace of innovation and industrial change and the more than 100,000 chemicals thought to be supplied for commercial use within the European Community. Very many of these will not have the market size ever to support the costs of the extensive testing needed to construct a full risk profile [1].

Further problems stem from the cost of establishing and putting into effective action a control system based upon an extensive framework of OELs. Whilst this can be readily justified in relation to some agents - silica and lead mentioned earlier, and asbestos are good examples, there is the understandable temptation to extend a schedule of limit values uncritically. This is much less of a problem if those OELs are established as professional guidelines than if they are given the force of law.

OELs are expensive to generate; costly to measure; costly to maintain; and transfer onerous responsibility from the manufacturer or supplier onto the body proposing the limit. They are necessarily value judgements whether derived by entirely expert committees

or with a wider social input. They continue to require skilled interpretation to convert them into practical controls - their primary purpose - and extensive and costly training to generate the capability within the intended user population to enable them to be properly applied. When converted into legal standards, further difficulties follow as scientific uncertainty is converted into regulatory precision and extensive quality assurance schemes may need to be put in place.

The apparent attraction of deriving ever more OELs has come under scrutiny within the UK and elsewhere and alternatives sought.

This movement within the UK has been given impetus by research that has indicated the statutory exposure limit system is very poorly understood by industry, especially small businesses [2]. Those employers depend very heavily on information from their supplier, not government, on how to control hazardous chemicals. They have great difficulty in converting technical information into practical control options, and they want targeted advice on what to do that is cost effective for their industry.

One possible solution

Information on the hazardous properties of chemicals supplied within the EU accompanies the substance in from the Safety Data Sheet (SDS). This must be provided by law. The most important harmful effects are described by standard 'Risk Phrases'. This information may also appear on labels. There is also a numbering system for these 'R' phrases which allows for a description such as 'R.45. May cause cancer' and there are several thousands of hazard classifications agreed at the EU level, or produced by suppliers. These far outnumber OELs yet derive from very similar toxicological information and relate much more closely to the market in chemicals. The question was asked "Given our experience of OELs and the practical experience of hygienists, is there a way in which substances can be grouped by 'R phrases' and linked to specific control advice that would probably be adequate to deal with the risks". This would much reduce the need for specific standards and monitoring, and it would meet the requirements of small businesses. The following scheme, broadly known as 'Control Banding' was developed to help control the risks by inhalation [3].

Simplifying the Toxicology

The many hazard warning phrases (R-Phrases) recognised in EU legislation were grouped by toxicologists experienced in limit setting into 5 categories, the first 4 of these representing increasing hazard and an expectation of reducing exposure limit. Each of these 4 groupings (A-D) therefore represents a banding of exposure limit in which the toxicologist would expect to find a substance with that particular classification. Category E contains the special cases such as carcinogens and mutagens. A sixth category 'S' covers substances which may cause harm by contact with skin and eyes (3).

Exposure Assessment

An understanding of risk requires a measure of likely exposure or exposure potential to set against the hazards of substance. A simple measure was needed to give an indication of this potential. This scheme is particularly targeted at meeting the needs of small businesses with little or no hygiene capability [4].

One parameter is quantity. This is assigned to one of three categories. Small (grammes and millilitres); medium (kilogrammes, litres) or large (tonnes or cubic metres).

Next is the problem of defining the likelihood of the substance becoming airborne. If a solid, how dusty ? If a liquid, how volatile ? How can this be represented in a way accessible to the small business ?

Solids are categorised in terms of three levels of dustiness: Low (pellet like solids, waxy flakes); Medium (granular; when used dust is seen but settles quickly; dust is left on surfaces after use); High (fine, light powders; dust clouds remain in the air). If in doubt, go for the dustier option.

Volatility presented a real problem. It was necessary to know the chemicals boiling point and the process temperature. Boiling point is usually available on the chemicals safety data sheet. It is possible to calculate vapour pressures, but this is daunting to the unskilled. A simple graphical method was developed linking boiling point and process temperature, leading to the assignment of the volatile liquid to one of three volatility bands. See Figure 1.

Control options

Hygienists agreed on three broad control options and a fourth category indicating that expert advice would be needed.

1. **General Ventilation**
   A good standard of general ventilation and good working practices.
2. **Engineering control**
   Typically local exhaust ventilation ranging from single point extract close to the source of hazards, to a ventilated partial enclosure. It includes other engineering controls e.g. cooling coils for vapours, but not full containment.
3. **Containment**
   Small breaches of containment are acceptable.
4. **Special**
   Expert advice is needed.

This information can be combined and feed into a template judged as likely to be appropriate by hygienists.

Hazard Band A choice of 5, decided by 'R' phrases

Dustiness or volatility A choice of 3

Quantity A choice of 3

Control Advice

Figure 1 : Graph to select volatility of liquid

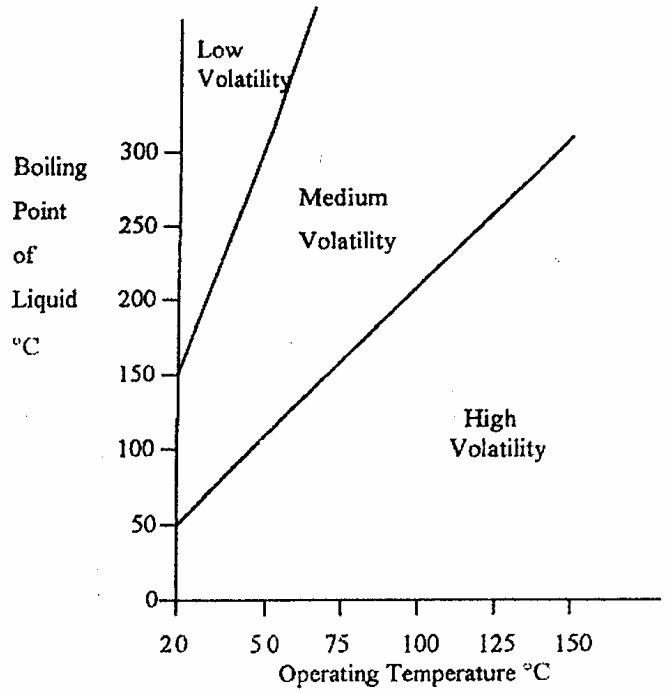
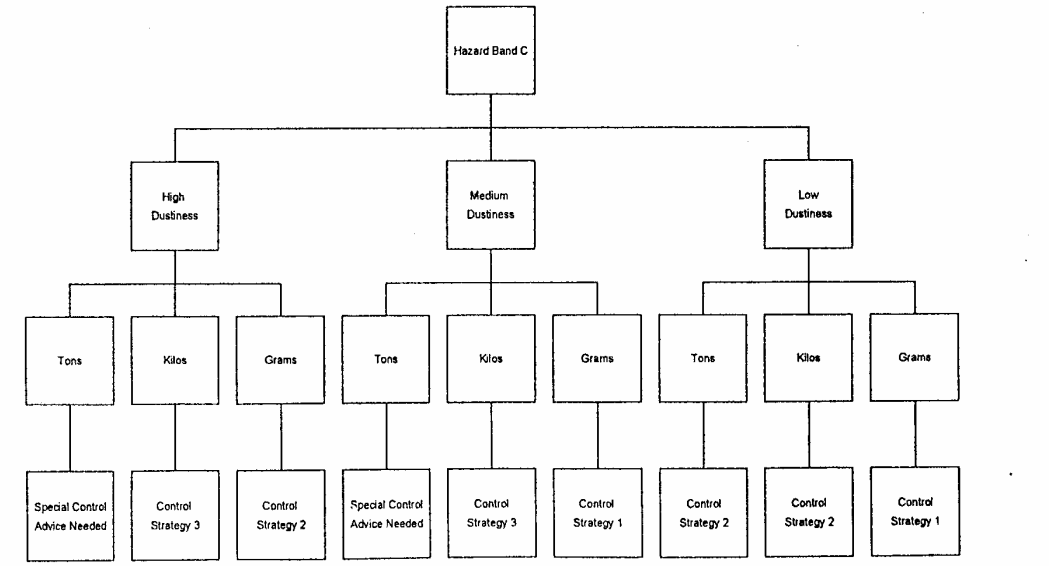


Figure 2 shows how the scheme works in this case using the template for a dust in hazard band C, which follows from its 'R' phrase. It is judged to be of medium dustiness, used in kilo quantities, the suggested control option is 3 (Containment).

If the same dust was used in tonne amounts, then special advice would be needed.

So far, therefore, the unskilled user has been assisted toward broad control guidelines. He will, however, know his own process and may then be able to make use of much more detailed control advice of direct relevance to his needs. For each of the control options there are detailed guidance sheets relating to unit operations and giving advice as to how that particular process can be controlled. Thus, for example, under Control.

Figure 2 : Hazard Band C - Dust Control



Approach 2 - Engineering Control - there is a list of processes. If we take 'Transfer' as an example there are processes such as 'sack filling' and a reference to a control sheet relating to that process. The control guidance goes beyond engineering controls and includes advice on protective equipment, management issues etc. It must tie in with national legal requirements.

Advice on general principles is also available for 'special' control options, and for chemicals causing harm via skin contact.

What Next

The Scheme was launched in May 1999 with strong support from the professional hygiene community; employers and employee representatives in the UK. It is now being converted into an electronic version.

The principles it raises are of widespread applicability, and there is a joint activity between the UK Health and Safety Executive; the International Labour Office, and the International Occupational Hygiene Association to produce generic guidance. It is seen as offering substantial practical benefits in all sectors, but especially where

there is no specific OEL or where monitoring of exposure by inhalation is not available.

CONCLUSIONS

A scheme as this does need to be handled cautiously. It is possible to think of circumstances in which it would not be adequately protective and it doesn't replace skilled judgement. A comparison of the estimated range of exposure limit based on 'R' phrase for more than a hundred substances with a health based OEL showed the scheme to be at least as protective as the limit in almost all cases. The banding approach does, however, address the important issue of the control of those very many thousands of substances that will never have a limit, and serves the needs of the vast majority of businesses that lack the capability to turn toxicological data into practical controls. It builds upon the established information flows into small business.

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