RISK REDUCTION IN GERMANY FOR CHLORINATED PARAFFINS USED IN METAL WORKING FLUIDS: REGULATOR'S VIEW ON TRIGGERS, DRIVING FORCES, PERSPECTIVES

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Introduction

Metal working fluids (MWF) are an important use area for chlorinated paraffins(CP; SCCP = short chained chlorinated paraffins, i.e. 10-13 carbon atoms in alkane chain; MCCP = medium chained CP, i.e. 14-17 C atoms; LCCP = long chained CP, i.e. 18 or more C atoms). In 1998, about 50 % of European SCCP sales and about 10 % of each MCCP and LCCP sales have been used for formulation of MWF[1].

Moreover, formulation and use of MWF are a major source of CP releases into the environment. About 96 % of 1784 t/a SCCP releases and 78 % of 1587 t/a MCCP releases (equally good estimates for LCCP not yet available) within the European Community arise from this aforementioned life cycle step of CP, according to recent risk assessments[2,3] implementing the European Existing Substances Regulation 793/93/EEC and following regulation 1488/94/EC on the principles of risk assessment as specified by Technical Guidance Documents (TGD)[4].

Germany's metal working industry is known as Europe's major user of MWF[5]. Concern substantiated by the hazardous properties of CP and by considerable CP concentrations measured in various environmental spheres has triggered much effort in Germany to minimize CP releases from metal working applications, mainly by substitution of CP in MWF and by development of new metal working techniques. The present contribution outlines relevant developments of risk reduction strategies implemented in Germany, of resulting 'state of the art' in metal working applications, and of driving forces for progress of risk reduction. Based on German experience so far in CP risk reduction, and taking into account recent discussion in international chemicals policy, particularly on European and OSPAR level, possible ways are discussed towards increasing efficiency, effectiveness and sustainability of successful risk management.

Methods and Materials

To gain a better understanding of the dynamics of CP risk reduction in Germany and for updating related knowledge already available in the German Umweltbundesamt, a number of distinguished experts has been interviewed during autumn 1999. Consulted experts belong to MWF using metal working industry, namely major car industry, to suppliers and developers of MWF, to waste management consultants, to Germany's biggest refinery of used oils, to the Federal Institute for Materials Research and Testing (BAM), and to academia (Technical University of Braunschweig). During the interviews, most statements have been confirmed valid for the whole group of CP.

Results and Discussion

According to MWF suppliers, intensive effort for substituting CP in MWF has already started in the mid-eighties in Germany. In 1985, 95 % of MWF have been chlorine free. The VDMA (German Association for Machine and Plant Construction Industry) stated in 1994, that a complete ban of SCCP in 1998 would provide no problems for its MWF using members[5]. According to a VKIS (German Consumer Group for Industrial Lubricants) statement in 1996, there is virtually no CP use by its members[5]. Remaining needs for CP are restricted to very few specialized applications and by the most conservative expert estimate < 10 % (probably < 5 %) of small and medium enterprises still depend on CP with selected applications. Today, 99 % of total MWF sales within Germany are confirmed to be chlorine free. Correspondingly, total annual SCCP sales in Europe decreased from 13,200 t in 1994 to 4,075 t in 1998[1]. From the viewpoint of German fluid formulation developers and waste management consultants, the issue of CP in MWF is 'water under the bridge'.

A whole bundle of triggering motives has been reported for initiating substitution of CP in the area of metal working in Germany:

1. global policy issues of pro-active companies, i.e. general strategies to restrict use of hazardous substances;
2. specific requirements of occupational hygiene and protection of the environment;
3. increasing disposal costs;
4. demands for general optimization of plants and processes;
5. direct or indirect pressure due to various regulatory instruments (e.g. Federal Ambient Pollution Control Act BImSchG, Water Protection Act WHG, Chemical Substance Act ChemG, Technical Regulation to Avoid Waste TA Abfall, Environmental Liability Act UmweltHG, Commercial and Industrial Waste Management Act KrW-/AbfG, Environmental Label 'Blue Angel' for selected lubricants).

Likewise, applied approaches and strategies as well as relevant driving forces for progress of the substitution process have been reported to be diverse:

1. large companies have developed lists of forbidden and undesired substances, CP among them; these lists are considered in all steps of processing optimization;
2. innovation covers all aspects of metal working and is not only related to CP risks:
   - new MWF formulations,
   - nature of processed metal alloys,
   - features of tools, e.g. transfer of MWF functions to specific tool coatings,
   - changes of process engineering parameters,
   - changes of applied processing types;
3. increased demand of CP free MWF by large companies has promoted fluid suppliers' effort to develop new formulations;
4. due to the initiatives of large companies, a sufficient economic basis for new formulations and sufficient facilities for testing in practice have become available;
5. after cease of German SCCP production, MWF formulators realized reduced CP availability and subsequently further increased their effort to develop chlorine free alternatives;
6. modern waste management keeps strong demand for chlorine free waste due to additional technical requirements for recycling and disposal of halogen containing waste.

Substitution costs have been estimated to several millions DM at one individual large car producer. To put this figure into context, a number of related additional particulars appears noteworthy:

1. cost estimates have been possible in advance, but no reliable benefit estimates;
2. initiation of action has been justified rather by general targets of company policy;

3. afterwards, net economic benefits could be stated due to generally improved cost efficiency of metal working processes;
4. precise allocation of innovation costs to 'substitution of CP' has not been possible;
5. the entire innovation process has been identified as main benefit of action;
6. substitution of CP occurred rather as desired side effect of action;
7. in general, more than 80 % of all processing innovations in metal working render benefits regarding costs and environment and occupational health;
8. subsequent benefits occur for less active companies and for small and medium enterprises (SME) *via* transfer of new know-how, which is also foreseeable for metal working industry in other countries.

Summing it up, after crossing a threshold of initial investment effort, the process of substitution turned out to be self-preserving, irreversible and net benefiting.

In Europe, the Existing Substances Regulation 793/93/EEC provides the relevant regulatory background for restrictions on marketing and use of hazardous substances. A comprehensive risk assessment is carried out for so-called priority substances, SCCP and MCCP among them so far, and is to be used as justifying basis for an appropriate risk reduction strategy. Risk assessment and risk reduction strategy are prepared by a Member State acting as rapporteur (UK in case of SCCP and MCCP), are subsequently discussed among all Member States, revised, finally approved, and committed to the European Commission. If restrictions on marketing and use are proposed as part of a risk reduction strategy, the European Commission translates the proposed restrictions into respective amendments of Directive 76/769 /EEC '...relating to restrictions on the marketing and use of certain dangerous substances and preparations'. In case of priority substances, amendments of 76/769 basically resemble the respective outcome of the existing substances program. However, the regulatory framework allows the Commission to take into account additional considerations.

SCCP are the first entry from the existing substances program priority lists, for which restrictions on marketing and use are to be formally implemented. Final approval of the respective 76/769 amendment is expected soon. Another international formal act, interfering with the outcome of the existing substances program, is PARCOM Decision 95/1 'on the phasing out of SCCP' in defined areas of use (cf. para. 2.a)-d) of decision). The German Ministry for Environment is prepared to implement national regulation in case of delayed progress on international, particularly EC level.

Differencesin detail among the aforementioned regulatory strategies are a widely discussed issue of chemicals policy at present. However, it appears more rewarding to point at the most important common issue, i.e. metal working applications as well justified target of regulatory action. As shown by the comprehensive EU risk assessments, this use is the major source for SCCP and MCCP releases to the environment (cf. introduction). Although not grounding on that systematic European procedure, working out comprehensive risk assessments and corresponding risk reduction strategies by Regulation 793/93, previous German risk management activities as well as PARCOM Decision 95/1 properly comprise metal working as area of priority action.

German experience illustrates technical and economic practicality of CP substitution in MWF and various benefits ascribed to related sweeping innovation processes. The complex, large-scale and lengthy procedure of the European existing substances program leads to well justified and defined restrictions on certain uses of a dangerous substance; it does not principally exclude environmental releases of this substance from possible new or increasing uses, but

would require reiteration of the same procedure in case of new developments. Consequently, some suggestions are given in the following to possibly improve efficiency of risk management:

If chemicals exhibit certain hazardous properties, like CP, general prohibition of uses susceptible to cause releases into the environment appears reasonable. The burden of justifying technically or socio-economically unrenounceable uses should be mainly laid upon interested industry, which namely should provide the relevant data necessary for a comprehensive risk assessment, properly targeted to the desired use. If resulting risks can be shown to be acceptable, possibly by proposing appropriate risk reduction measures derived from the elaborated risk assessment, this specific use of the substance could be permitted by explicit notification or registration. However, agreement of definite threshold values for clear identification of substances exhibiting 'certain hazardous properties' will require further spirited discussion among all involved parties. At the same time, various supporting measures might be helpful to encourage and reward sweeping innovation endeavors, which repeatedly proved to yield benefits for environment and health and economy.

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