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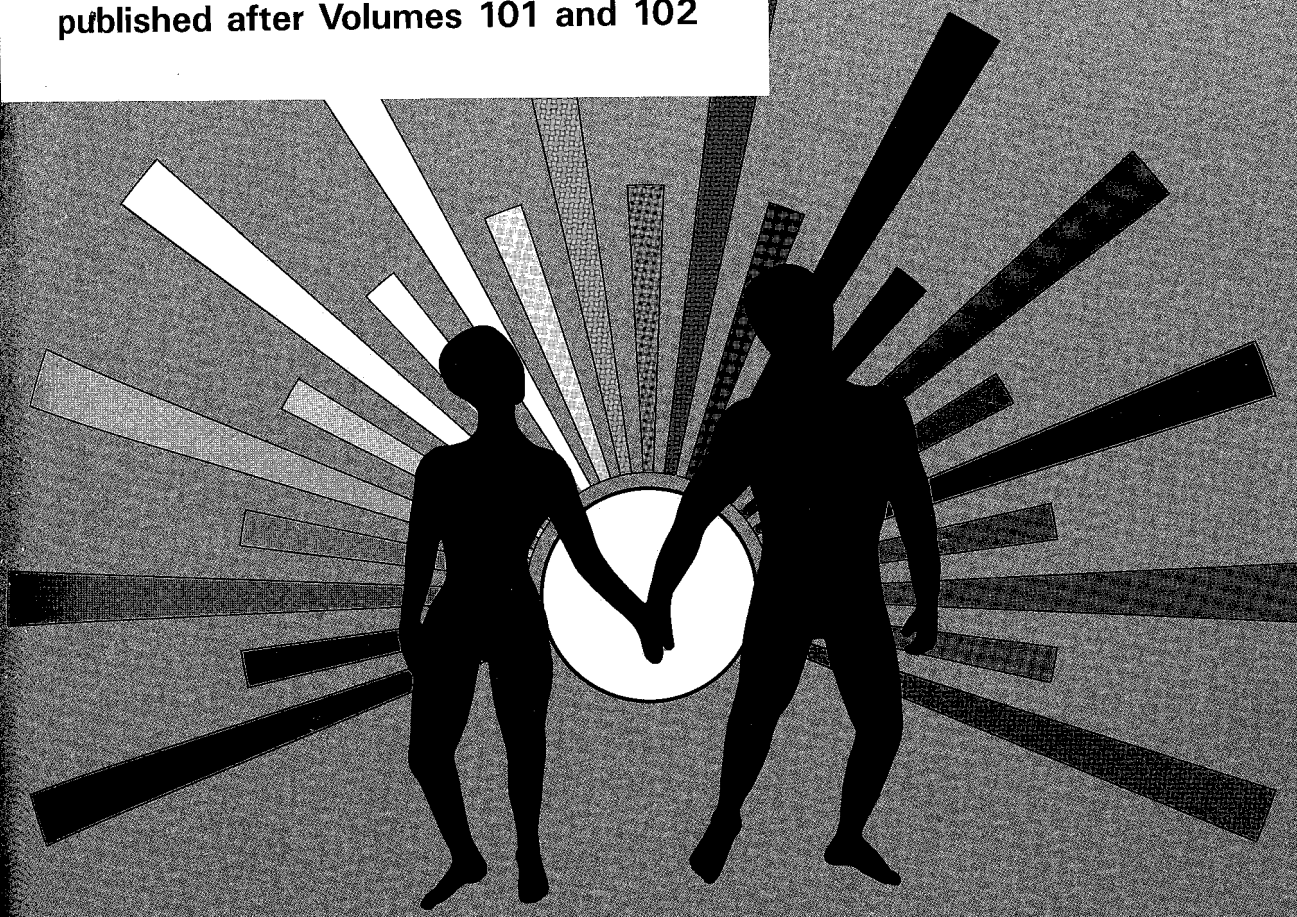

SPECIAL ISSUE:
EXPOSURE LIMITS FOR OCCUPATIONAL AND ENVIRONMENTAL CHEMICAL POLLUTANTS

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THE NORDIC EXPERT GROUP, AN INTER-NORDIC PROJECT FOR ASSESSMENT OF OCCUPATIONAL RISKS

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ABSTRACT

Risk management and risk control within the occupational environment are individual national issues in the Nordic countries. Within the area of occupational exposure limit setting there is, however, some collaboration. As an internordic project the Nordic Expert Group for Documentation of Occupational Exposure Limits was started in 1977, in order to develop scientific criteria documents. The documents are used by the five national regulatory authorities as a common scientific basis for setting national occupational exposure limits.

In risk management in the Nordic countries the Nordic Expert Group deals with the scientific issues and the regulatory authorities deal with the transscientific issues, taking economical aspects and technological feasibility into account. The setting of occupational exposure limits is thus an administrative (or political) concern and the limit values are norms rather than limits between hazardous and nonhazardous concentrations.

The work by the Nordic Expert Group exemplifies the fact that the scientific part of risk management can be preferentially performed on an international basis.

Key words: occupational standard, Nordic Expert Group, risk management, criteria document

INTRODUCTION

The Nordic countries, sometimes called the Scandinavian countries, consist of five individual nations. There are three kingdoms; the kingdom of Denmark with approximately 5.1 million inhabitants; the kingdom of Norway with approximately 4.2 million inhabitants; and the kingdom of Sweden with approximately 8.4 million inhabitants. There are furthermore the two republics; Finland with approximately 4.8 million inhabitants; and Iceland with about 240,000 inhabitants.

Historically, geographically and culturally these five countries have much in common, and they have close ties. The language spoken to day in all countries except Finland has the same origin, but has developed separately in the different countries. The Finnish language has a completely different origin, but a fraction of the population in Finland has Swedish as its native language.

In many respects the five nations thus act individually and independently. Denmark, Norway and Iceland are members of the NATO (North Atlantic Treaty Organization), Sweden and Finland are neutral. Denmark is a full member of the EC (European Communities), the other countries are not. In other areas joint ventures and collaboration

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are common. For instance the labour sector, social security systems etc. are closely harmonized, although most legislation is national.

Risk management and risk control within the occupational environment are individual national issues, as are occupational standard setting and work environment legislation in general. There is, however, some collaboration within this area.

INTERNORDIC COLLABORATION

The Nordic Council of Ministers is an international body for the five governments established as a channel for collaboration, coordination and exchange of ideas concerning various issues. The Council has established standing committees for specific issues, is funding projects in scientific research, in exchange of experts and experience etc.

One such committee is the Nordic Senior Executive Committee for Occupational Environmental Matters. This committee has, among other things, the task to propose which internordic research projects should be funded by the Council. Any scientist in the field has the opportunity to apply for grants from the Council.

In late 1977 a project was started in order to develop scientific criteria documents for occupational standard setting. The documents are ment to be used by the five national regulatory authorities as a common scientific basis for setting national occupational exposure limits.

The management of the project was given to a standing group of scientists; The Nordic Expert Group for Documentation of Occupational Exposure Limits. Since 1987 the group has consisted of one scientist from each of the five countries. The scientists are specialists within the fields of toxicology, occupational medicine, epidemiology, pharmacology and veterinary medicine, respectively. A small secretariat consisting of two persons, one scientific secretary and one assistant, is provided for the current matters. The secretariat is presently situated in Sweden. The salaries for these two persons are paid by the Nordic Council, which also pay the expenses of the Expert Group. The yearly budget is around DKK 850,000 (ca USD 125,000).

CRITERIA DOCUMENTS

The process of producing a criteria document is quite a time-consuming one. Initially, the Expert Group asks the regulatory authorities in the five countries to present priority lists of chemical substances needed to be reviewed. From the lists the Expert Group chooses the substances to be investigated. Criteria for the decision are the amount/volume of the substance in use, the number of workers exposed, and the potential toxicity of the substance. It is favorable for the decision, but not a necessity, if the substance is on the priority list from more than one country.

The task of writing a document is given by the Expert Group to a scientist in one of the five countries. The secretariat provides "instructions to the author", and also, in collaboration with the author, performs the search in different data bases for relevant literature.

The draft document is discussed with the author during an Expert Group meeting.

The meetings are usually held twice or three times a year, each time at least two full working days. If necessary, a specialist can be asked to give comments during the meeting. After revision and editing, the document is published and sent to the regulatory authorities in the five countries.

The documents are reviews of published scientific data. The format of a document is usually as can be seen in Table 1. Included in chapter 2 is also a short description of methods for analysis of air concentrations. The chapter on kinetics involves uptake, distribution in the body, biotransformation, elimination, and biological exposure indicators, if there are any. Under the heading of "general toxicology", LD_{50}-values are presented as are cellular toxicology, effects on enzyme activities etc.

TABLE 1

The format of criteria documents from the Nordic Expert Group

1.	Physical and Chemical Data
2.	Occurrence and Uses
3.	Kinetics
4.	General Toxicology
5.	Effects an Organs (presented organ by organ)
6.	Immunotoxicity and Allergy
7.	Mutagenicity and Genotoxicity
8.	Carcinogenicity
9.	Reproduction Toxicology
10.	Exposure-Effect and Exposure-Response Relationships
11.	Research Needs
12.	Discussion and Evaluation
13.	Summary
14.	References

Where data so permit, dose-effect and dose-response relationships are given tablewise. No mathematical extrapolation from higher doses to lower doses is performed, nor an extrapolation from animal data to humans. When evaluating carcinogenicity the Expert Group follows the criteria used by the IARC (International Agency for Research on Cancer) as presented in their series of monographs.

Finally, a critical effect is defined, an effect which should be taken into consideration when establishing a numerical value of an occupational exposure limit. The critical effect is thus the effect noted at the lowest exposure level. It could be an acute effect such as irritation of the mucous membranes or it could be a non-reversible effect such as carcinogenicity.

It should be emphasized that a numerical occupational limit value is *not* proposed in the criteria document by the Expert Group.

As mentioned above, the documents are published. From the start of the project 1978, up to now, more than 80 documents have been published in Arbete och Hälsa, the scientific journal of the Swedish National Institute of Occupational Health. The documents are originally written in a Scandinavian language with a short English summary.

From 1987 on, all documents are translated in extenso into English and published once a year (see Appendix).

OCCUPATIONAL EXPOSURE LIMIT SETTING PROCESS

The next step in the process of establishing occupational exposure limits is a national one. In principle, this process is similar in the five countries and Sweden will be used as an example.

Based on the criteria documents from the Nordic Expert Group a national working group (the Criteria Group) produces a written consensus report. The Swedish Criteria Group consists of research scientists within the National Institute of Occupational Health, external university professors in occupational medicine, and scientific experts from the employers' and employees' organizations. The important point in the process is that consensus is reached between the researchers and the scientific experts from the labour market. The evaluations made are thus easily disseminated, and controversial issues in the scientific material are clarified in the Criteria Group.

The Swedish Criteria Group is a standing scientific committee with the exclusive task to prepare consensus reports based on criteria documents and/or other relevant sources. The other Nordic countries do not have a standing committee for this purpose but rather ad hoc groups. Another difference is that the Swedish consensus reports are published yearly (in Arbete och Hälsa, see Appendix(, but in the other four countries the consensus is not published but it is officially available.

The regulatory authority performs a cost-benefit analysis, considers technological feasibility criteria and analyses the consequences of a possible change in the occupational exposure limits. The data are presented to a working group, which includes representatives from employers' and employees' organizations. After consideration of the data presented and of the scientific criteria, and of risk and exposure levels that might be acceptable, the working group proposes a new occupational exposure limit value.

The data underlying the proposal are usually not published although they are officially available.

The proposal of a numerical value is then referred to several interested bodies in the society for additional consideration, before the value is finally promulgated by the authority.

RISK MANAGEMENT

The risk management could be divided into five steps; namely risk identification, risk estimation, risk evaluation, risk acceptance, and risk control. Risk identification, i.e. demonstrating the presence of toxic pollutants in the work environment, may be considered to be a scientific issue. Risk estimation, including establishment of dose-effect and dose-response relationships, may as well be considered to be a scientific issue.

Risk evaluation includes the decision upon which effect should be the critical effect for standard setting. This is both a scientific and a transscientific issue. Trans-scientific

issues are in this respect areas where laymen may contribute as well as the specialists to the decisions.

The fourth step in risk management, risk acceptance, may be considered to be a trans-scientific issue. The risk acceptance is e.g. an agreement upon what frequency of disease or discomfort can be tolerated taking economical issues and technological feasibility into account. The risk control, finally, is in most Nordic countries legally a responsibility of the employers.

In the risk management in the Nordic countries the Nordic Expert Group, as well as the national scientific groups, all deal with the scientific issues and the regulatory authorities deal with the trans-scientific issues.

Although the scientific basis is invaluable in setting occupational exposure limits, it may not be sufficient and a trans-scientific basis may give important contribution in the process. This makes the occupational exposure limits in the Nordic countries norms rather than limits between hazardous and non-hazardous concentrations.

The occupational standard setting is thus an administrative (or political) concern in the Nordic countries. This is, for example, reflected in the name of the Norwegian list of occupational exposure limits, which is called "Administrative Norms for Pollution in the Work Environment" (Administrative normer for forurensning i arbeidsatmosfære).

CRITERIA FOR OCCUPATIONAL EXPOSURE LIMITS

Although the scientific basis is common to all Nordic countries the actual numerical value for a substance may differ between the countries. Partly this is due to differences in the time decisions were made. But the differences in values in the national lists from the individual Nordic countries may also reflect differences in assessments of what is technologically and socioeconomically feasible in each country. These transscientific set of criteria seems to be used when exposure can be controlled at a level lower than the minimum supported by toxicological and medical arguments.

The criteria used for setting occupational exposure limits in the Nordic countries can be assessed only partially. There is published documentation in form of criteria documents from the Nordic Expert Group for less than 40 per cent of the substances listed. For many of the values, especially for many of the old values, documentation from the US ACGIH has played an influential role. For a great many substances documented by the Nordic Expert Group no change in occupational exposure limit value was deemed necessary by the regulatory authorities.

When discussing the national lists of occupational exposure limits it should be pointed out that in Denmark and Sweden the values have a legal status, while in Finland, Norway and Iceland they are recommended values only.

Finally, some examples on occupational limit values in the five countries are presented in order to illustrate what has been said. The examples are grouped according to the critical effect given in the criteria documents from the Nordic Expert Group.

The most common critical effect used throughout the years has been irritation to eyes, nose and throat. As can be seen from Table 2 there are some differences in values but no individual Nordic country has systematically lower or higher values.

TABLE 2

Substances reviewed by the Nordic Expert Group, with occupational exposure limits (mg/m^3) from the Nordic countries. Critical effect: Irritation

Substance	DK 1988	SF 1987	IS 1978	NO 1984	SE 1987
Acetaldehyde	45	90	90	90	45
Allyl Alcohol	5	5	5	5	5
Ammonia	18	18	18	18	18
Cyclohexanone	100	200	200	100	100
Ethylene Glycol	130	125	260	50	130
Formaldehyde	1.2	1.3	1.2	0.6	0.6
Hydrogen Fluoride	1.6	4	2	2	1.7
Tetrachloroethylene	200	335	200	200	140
Trichloroethylene	160	160	160	160	110
Wood Dust	4	5	5	1—5	3

TABLE 3

Substances reviewed by the Nordic Expert Group with occupational exposure limits (mg/m^3) from the Nordic countries. Critical effect: Carcinogenicity/mutagenicity

Substance	DK 1988	SF 1987	IS 1978	NO 1984	SE 1987
Benzene	16	15	15	15	16
Chromium	0.5	0.5	0.5	0.5	0.5
Epichlorohydrine	1.9	1.9	1.9	1.9	1.9
Ethylene Oxide	1.8	2.8	36	—	9
Inorganic Arsenic	0.05	0.01	0.05	0.01	0.03
Pentachlorophenol	0.5	0.5	0.5	0.5	0.5
Propylene Oxide	12	240	240	12	12
Styrene	105	35	210	210	110
Vinyl Chloride	3	15	3	3	2.5

When it comes to carcinogenic/mutagenic/cytotoxic properties as the critical effect (Table 3), the values are similar for most substances, considering temporal factors. The classification and listing of carcinogens is a separate issue which will not be addressed here.

During the past two decades, chemicals acting on the central nervous system or on the peripheral nervous system have been a focus of scientific research in the Nordic countries. Data thus obtained have also been seriously considered when standards were set. Most of the substances for which neurotoxic effect was the critical one, are organic solvents. Here again the values do not differ significantly between the Nordic countries (Table 4).

TABLE 4

Substances reviewed by the Nordic Expert Group with occupational exposure limits (mg/m^3) from the Nordic countries. Critical effect: Neurotoxicity

Substance	DK 1988	SF 1987	IS 1978	NO 1984	SE 1987
Ethylbenzene	217	435	435	435	200
Halothane	40	8	—	40	40
n-Hexane	180	180	180	180	180
Inorganic Lead	0.1	0.1	0.1	—	0.1
Methanol	260	260	260	260	250
Methyl Bromide	20	60	60	20	60
Methyl Ethyl Ketone	290	440	440	440	150
Toluene	190	375	375	280	200
1,1,1-Trichloroethane	540	540	540	540	400
Xylenes	217	435	435	330	200

TABLE 5

Substances reviewed by the Nordic Expert Group with occupational exposure limits (mg/m^3) from the Nordic countries. Critical effect: Embryotoxicity

Substance	DK 1988	SF 1987	IS 1978	NO 1984	SE 1987
Acrylonitrile	4	4.5	45	4	4.5
Di-(2-ethylhexyl)-phthalate	5	5	5	5	5
Nitrous Oxide	180	—	—	180	180

In Scandinavia generally, teratogenic/embryotoxic effects (Table 5) have been considered the critical effect for only a few chemicals. This is merely due to lack of data, rather than bias.

CONCLUDING REMARKS

In conclusion: the work by the Nordic Expert group exemplifies the fact that the scientific part of risk management preferentially can be performed on an international basis. During the last year the Expert Group has extended its international contacts. An agreement has been set up between the Expert Group and the Dutch Expert Committee for Occupational Standards as well as the US NIOSH (Division of Standards Development and Technology Transfer), with the purpose to write joint criteria documents. Based on these joint efforts the trans-scientific part will then be the responsibility of the individual country.

Joint ventures like this are thus advantageous to both parties, since writing criteria documents is a time-consuming process. The trans-scientific part of the risk management is, on the other hand, a national issue. This fact makes a simple comparison of occupational exposure limit values from different countries partly misleading. Within the context of different health policies, differences in technical development and economic capacities, national occupational limit values are to differ. However, all countries can strive to a common approach in standard setting.

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Holmberg, B., Lundberg, P.: Assessment and management of occupational risks in the Nordic (Scandinavian) countries. Am J Ind Med 15 (1989) 615—626.

APPENDIX

A. CRITERIA DOCUMENTS FROM THE NORDIC EXPERT GROUP AVAILABLE IN ENGLISH

Creosote	Arbete och Hälsa 1988:33, pp 7—51
n-Decane and n-Undecane	Arbete och Hälsa 1987:40, pp 45—73
Methyl Bromide	Arbete och Hälsa 1987:40, pp 7—44
Methyl Isobutyl Ketone (MIBK)	Arbete och Hälsa 1988:33, pp 53—76
Methylene Chloride	Arbete och Hälsa 1987:40, pp 75—120
Nitroalkanes	Arbete och Hälsa 1988:33, pp 115—163
Vinyl Acetate	Arbete och Hälsa 1988:33, pp 77—113

B. CONSENSUS REPORTS FROM THE SWEDISH CRITERIA GROUP

has been published, in English, in the following volumes of Arbete och Hälsa:

1981:21, 1982:9, 1982:24, 1983:36, 1984:44, 1985:32, 1986:35, 1987:39, 1988:32.

C. CRITERIA DOCUMENTS FROM THE SWEDISH CRITERIA GROUP AVAILABLE IN ENGLISH

Asbestos and Inorganic Fibers	Arbete och Hälsa 1981:17, pp 1—103
Beryllium	Arbete och Hälsa 1984: 2, pp 1—60
Grain Dust	Arbete och Hälsa 1988:14, pp 1—63
Man Made Mineral Fibres	Arbete och Hälsa 1981: 4, pp 1—16
Plastics Dust	Arbete och Hälsa 1987: 3, pp 1—32

Volumes of Arbete och Hälsa can be ordered from: National Institute of Occupational Health, Publication Service. S-171 84 SOLNA, Sweden.