

PROBAS: The Danish Product Register Data Base — A national register of chemical substances and products

Mari-Ann Flyvholm, Poul Andersen, Inge D. Beck and Nanna P. Brandorff

The Product Register Department, Danish National Institute of Occupational Health, Lersø Parkallé 105, DK-2100 Copenhagen (Denmark)

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Abstract

A description of the structure, the content, and the purpose of the Danish Product Register Data Base (PROBAS) is given. The PROBAS data base is a national data base started in 1980. Data sources have been notifications of hazardous chemical products and data from investigations on occurrence or use of chemicals made by, for example, the Danish National Institute of Occupational Health. Examples of the content of the register are presented, such as the most frequently registered product categories, or the most common substances. As of January 1991, PROBAS contained information on about 53,300 chemical products. Information on the composition of about 30,000 chemical products was computerized. The possibilities and limitations of the use of a national data base on chemical products are discussed.

1. Introduction

Information systems on chemicals have become important tools for monitoring and controlling emission from and occupational exposure to chemicals, and for preventing adverse effects on environment and health caused by chemicals. From the very few product data bases described in literature, it seems as if data bases are often established for selected product categories or industrial areas of use, where data on products are collected as part of investigations on occupational or environmental hazards [1,2]. A reason for the very few publications on product data bases could be the difficult task of obtaining data on product ingredients caused by the confidentiality of composition of commercial products [3], or the explanation could be that such data bases mainly serve administrative or poison control centre purposes [4], making them inappropriate for scientific investigations and publications. Most of the few chemical and occupational data bases reported in the literature are on hazardous (pure) substances like RTECS, on material safety data sheets, or on selected groups of commercial products, e.g. cosmetics or pharmaceuticals. Nation-wide surveys like National Occupational Hazard Survey (NOHS) and National Occupa-

Correspondence to: Dr. M.-A. Flyvholm, The Product Register Department, Danish National Institute of Occupational Health, Lersø Parkallé 105, DK-2100 Copenhagen (Denmark).

tional Exposure Survey (NOES) [5] have provided data bases on trade name products, their composition and potential exposure to the ingredient substances, and a model for the identification of high risk occupational groups by linkage with RTECS data [6]. In Sweden and Norway national product information systems like the Danish Product Register have been developed [7,8].

In this paper we describe the structure, the purpose, and the content of the Danish Product Register Data Base (PROBAS), and discuss the experiences with and the use of a national data base on chemical substances and products.

1.1 The Danish Product Register Data Base

The Danish Product Register is a governmental data base for information and evaluations concerning substances, materials and products used in Denmark. The development of PROBAS started in 1980. The data base was established by the Ministry of the Environment and the Ministry of Labour which administer parts of the Danish legislation concerning chemicals. The Product Register is located at the Danish National Institute of Occupational Health (DNIOH), which is part of the Danish Labour Inspection.

The purpose of PROBAS is to collect and utilize information on the use and the adverse effects on health and environment of substances and products used in Denmark.

2. Methods

2.1 The data base structure

The technical configuration of PROBAS is a Local Area VAX-cluster. The data base management system is ADABAS using inverted lists for data access with applications written in NATURAL, a programming language designed for ADABAS. These tools provide practically unlimited searching and reporting facilities for the many different situations where information retrieval is required. Data and conversion tables are stored in 30 files. An overview of the main files is given in Fig. 1.

The data base has been designed with three interconnected subsystems, i.e.

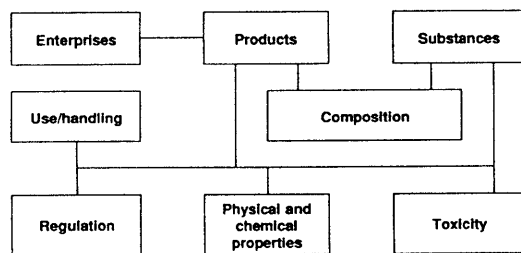


Fig. 1. An overview of the main files in PROBAS and their interconnection.

for products, for substances and for enterprises. Substances are defined according to the European Economic Community (EEC) directives as pure substances, i.e. chemical elements and their compounds, including polymers, while products are preparations (materials) as well as substances with trade names. In the subsystems each entity is uniquely defined by an identification number accompanied by a check digit for control. For substances Chemical Abstract Service Registry numbers (CAS RN) are used. For products Product Registration numbers (PR No) have been assigned, and for companies numbers identical to those used by the National Business Register are used. The access to PROBAS is restricted according to special security regulations, to guarantee confidentiality of information on product composition, manufactured or imported volume, etc. [9].

3. Material

3.1 Data sources

The data on *products* have been compiled from information submitted by Danish manufacturers, importers, agents or their international suppliers according to notification rules, surveys and research projects made by DNIOH and from other relevant sources. Notification rules cover hazardous products, classified as such according to EEC rules, or by special order from the Danish Labour Inspection [10] or the Danish Environmental Protection Agency. In addition, information on other products for occupational and consumer use has been recorded. PROBAS is currently supplemented by data from investigations made by for instance, DNIOH. In addition to data on notifications and investigations, data on all products causing written inquiries to the Register Department have been recorded. For such products it has not always been possible to get information for all the data fields shown below. Items recorded for products include: administrative information; chemical composition; industrial area of use; product category; quantities used or marketed in Denmark; physical and chemical properties; toxicity; classification; labelling; safety measures; transport classification; and company identification for notifiers (manufacturers, importers) and in some cases also user companies. Components in products are substances identified by CAS RN, substances without CAS RN identified by assigned numbers, or raw materials (trade name products identified by PR No). Codes for industrial areas of use, corresponding to the International Standard Industrial Classification Codes (ISIC), have been recorded. For the product categories (fields of application) codes were developed by the Product Register [11].

The *substances* included in the data base were based mainly on the EINECS Register, other registers, and lists of selected substances of toxicological or ecotoxicological importance. The data on substances have been derived from literature, handbooks, regulatory lists, lists of substances with biological ef-

fects, criteria documents, guideline documents, and notifications of substances and products. Items recorded for substances are names, CAS RN, other registry numbers, molecular formula and weight, UN numbers, EEC numbers, administrative and legislative regulations, occurrence on lists of substances with specific toxicological effects, and in principle the same items as for products if available.

The data on *enterprises* have been submitted by the notifiers themselves, who are Danish manufacturers, importers or agents, or the information has been forwarded by international suppliers. Information could also derive from the user companies. Each establishment was assigned a reference number identical with that from the Danish Central Register of Enterprises and Establishments. Items recorded for the establishment are name, telephone number, address, and may include ISIC code and number of employees (mostly for user companies).

4. Results

As of January 1991, PROBAS contained information on about 53,300 chemical products. At present all supplied information has been computerized for about 31,000 products. Data on partly computerized products included as a minimum identification of the product, the manufacturer, producer or importer, and sometimes the product category. The number of products for which the specified information categories were recorded are given in Table 1. The data for classification, labelling and safety measures are supplied by the notifiers or suppliers, and are in general not controlled by the authorities. For about

TABLE 1

Information categories for products and the number of products, as of January 1991, (based on 53,300 products)

Information category	Number of products
Chemical composition	30 000
Product category (field of application)	31 900
Industrial area of use	23 400
Physical and chemical properties	22 700
Toxicity data	13 100
Classification and labelling	17 100
Safety measures	16 700
Transport classification	5 000
Product Registration numbers assigned to notifiers	11 800

TABLE 2

Number of computerized products divided into degrees of knowledge on product composition, as of January 1991 (based on 31,000 products)

Quality of product composition	Number of products	Percentage
All components identified, percentage up to 100	14 040	45
Alternating components, or percentage variation	3 480	11
Sufficient information for evaluation of effects	4 240	14
Components partially identified	6 400	21
Components totally unidentified	1 050	3
Quality not yet evaluated	1 820	6

Industrial areas of use:

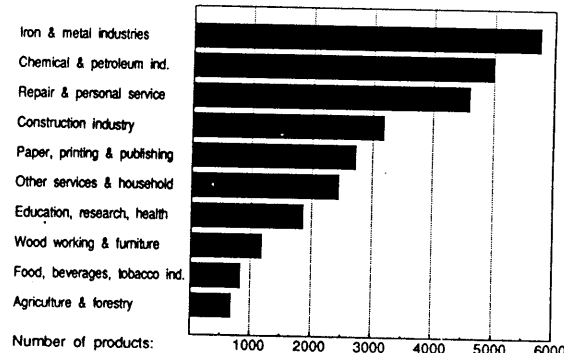


Fig. 2. The most frequently recorded industrial areas of use, based on 23,400 products registered with this information, January 1991.

11,800 of the notified products PR Nos were assigned to the notifying companies implying that the Product Register has information on the complete composition of the products and that the notifying companies are obliged to report alterations of the submitted information.

The information on product composition has been evaluated and a code for quality has been assigned. The numbers of fully computerized products divided into degrees of knowledge on product composition are given in Table 2. For more than half of the products the complete composition was known. For 70% of the products the information on composition was sufficient to evaluate the toxic effects of the product or the suggested classifications and safety measures.

The most frequently recorded industrial areas of use, based on 23,400 prod-

Product categories:

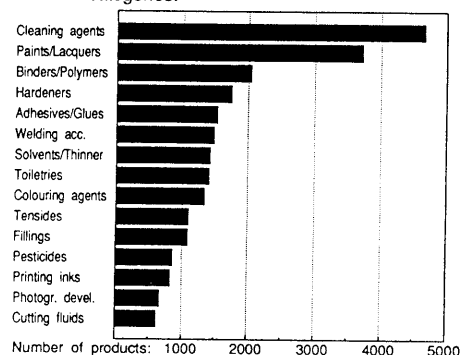


Fig. 3. The 15 most frequently registered product categories based on 31,900 products registered with this information, January 1991.

ucts registered with this information, January 1991, were the iron and metal industry, chemical industry, and repair and personal services, followed by the construction industry and paper, printing and publishing each of which accounted for nearly the same number of registered products (Fig. 2). The 15 most frequently recorded product categories based on 31,900 products registered with this information, January 1991 are shown in Fig. 3. The two major product categories were cleaning agents and paints/lacquers which together made up 26%.

In the substances file PROBAS had information on more than 130,000 CAS RN including more than half a million names. The number of specific compounds represented by these records was uncertain because Chemical Abstract Service has assigned generic index names and registry numbers to many homologous series of compounds, mixtures of isomers, natural products and different fractions of mineral oil. The number of CAS RN for which certain information cat-

TABLE 3

Information categories for substances and the number of CAS RN, as of January 1991 (based on 130,000 CAS RN)

Information category	Number of CAS RN
Classification and labelling	5 840
Toxicity data	2 379
Transport classification	2 122
Physical and chemical properties	2 004
Occupational exposure level	1 544
Safety measures	252

TABLE 4

Most frequently recorded substances in PROBAS as of January 1991, based on about 30,000 products registered with information on product composition

CAS RN	Number of products	Substance name
7732-18-5	7 878	Water
1330-20-7	4 060	Xylene
13463-67-7	2 496	Titanium dioxide
7631-86-9	2 208	Silica
108-88-3	1 906	Toluene
1309-37-1	1 618	Iron oxide (Fe_2O_3)
106-89-8	1 582	Epichlorohydrin
1333-86-4	1 417	Carbon black
1675-54-3	1 412	Bisphenol-A-diglycidyl ether
123-86-4	1 377	Butyl acetate
67-63-0	1 375	2-Propanol
50-00-0	1 368	Formaldehyde
14807-96-6	1 241	Talc ($\text{Mg}_3\text{H}_2(\text{SiO}_3)_4$)
25085-99-8	1 191	Bisphenol-A-diglycidyl ether, homopolymer
471-34-1	1 103	Calcium carbonate
71-36-3	1 098	1-Butanol
57-55-6	1 093	1,2-Propanediol
111-15-9	1 057	2-Ethoxyethyl acetate
7727-43-7	1 030	Barium sulfate
64-17-5	1 016	Ethanol

egories were recorded are given in Table 3. For about 1,800 substances, information on classification and labelling was official authority (EEC) classifications, the remaining part was suggested by importers. Toxicity data included inventories of carcinogens, reproductive toxicants, allergens or neurotoxic substances [12-15]. Table 4 shows the substances most frequently recorded as components in PROBAS. The numbers given in the table are the numbers of recorded products, where the substances were registered either directly or indirectly as components of constituent commercial raw materials.

5. Discussion

An ideal product registration should cover all products in use at any time and contain complete chemical identification and percentage content for all constituents, and the information should be easily retrievable. Although, the design of PROBAS permits surveying based on any entrance recorded, and although the objectives in the long view are to cover the total product assortment as well as current notification rules and cross-sectional registration surveys contributing to the stepwise product registration, there are still uncovered

product groups, and furthermore, the amount of information given may also be limited for some registration systems. Moreover, the demand for submission of updated information only includes products with PR No officially assigned to notifiers.

The degree of coverage varies according to product category and trade of use. Estimates derived from investigations in manufacturing and service industries [16], and in the wood and furniture industry [17,18] showed that PROBAS had a coverage of 34–50% of products used in Danish workplaces. Since certain product categories were covered by special notification rules or had been subject to special investigations, the information in PROBAS on such categories of products is considered complete for the Danish market, e.g. epoxy and isocyanate products, asbestos-containing products, pesticides, cleaning agents (all by special order) and cutting fluids, which have been the subject of a national study. The Danish product registration has an overrepresentation of hazardous products due to the notification rules, which means that the degree of coverage for hazardous products is higher than the estimated 34–50% based on both hazardous and non-classified products. The most frequently recorded trades of use and the most frequently recorded product categories reflect the selection of products for inclusion in the data base, since the notification systems have included mainly hazardous products for industrial use, and cleaning agents.

The amount of information on chemical substances is very spare, mainly because only limited resources have been allocated to the update of this part of the register, but also due to the fact that only a minor fraction of substances has been investigated for physical and toxicological properties. The counts listed in Table 3 can therefore be considered as ambiguous, e.g. physical and chemical properties can be anything ranging from a single boiling point to extensive information on density, solubility, partition coefficients, vapour pressure at many different temperatures, etc.

The fact that certain product categories have been registered in full is also reflected in the list of the most frequently recorded substances in PROBAS. Thus, epichlorohydrin, bisphenol-A-diglycidylether and its polymers, certain fillers and pigments are typical constituents of epoxy-based products.

Although information derived from PROBAS cannot provide complete estimation of exposure, PROBAS constitutes a very useful system for surveillance of exposure to chemicals in Denmark, providing qualitative and semiquantitative surveys on occurrence or amount of substances used, product categories, industrial area of use, enterprises involved, etc. As the need for classification of the thousands of chemicals in workplaces and environment has become evident, the limited resources for testing physical, chemical and toxicological properties are heavily dependent on priority settings. Lists of substances with high exposure potentials derived from PROBAS and similar registers can be important tools for the determination of these priorities.

5.1 Examples of surveys and research based on PROBAS data

A registration in 1985 of all products containing more than 0.1% of substances considered to be carcinogenic according to the official Danish list of carcinogens adapted from the International Agency for Research on Cancer [12] showed that one third of the 198 carcinogens were not used in Denmark. The 16 most widely used carcinogens made up 99.8% of the total consumption of about 250,000 tons per year. Benzene alone made up about half of the total consumption of carcinogens in Denmark [19].

A survey of selected allergens in registered chemical products has shown that some allergens can be found in many different product categories, whereas others occur in to a few categories [20]. Furthermore, information on the occurrence and use of contact allergens and correlating data on clinical patch tests from consecutively tested eczema patients make it possible to estimate the sensitizing risk for contact allergens [21].

Registered product categories such as cutting fluids have been used to identify related health hazards. Typical constituents and toxicological data sheets have been listed [22].

In a survey of the use of selected product categories in automobile repair shops, 960 chemical products in the automobile trade were recorded. Proposals for avoiding constituents with acute and chronic effects were given, and toxicological data sheets on typical not previously evaluated constituents were made [23].

Computerized product information using common coding gives possibilities of linkage to other data bases, e.g. the Central Register of Enterprises and Establishments to reveal groups of potentially exposed workers, or to effect registers to reveal associations between exposure and diseases. Mappings of the distribution of neurotoxic substances and reproductive toxicants have also been made by DNIOH [13,15] as well as linkages between occupational exposures and cancers [24].

6. Conclusion

Information on product composition is essential in dealing with risk assessment and management, priority setting in controlling occupational hazards, and planning of investigations. PROBAS, a Danish national data base continuously collecting product data, can provide this information, although the limitations should be taken into consideration.

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