IPCS News

The Newsletter of the International Programme on Chemical Safety

Issue 1 **March 1992**

Why a newsletter?

The IPCS has grown from humble beginnings and a handful of staff in 1980 to a worldwide network involving many hundreds of scientists and administrators. In the early 1980s it was producing just a few publications per year, whereas the annual output now runs into scores of monographs and other documents. Keeping track of all the IPCS activities is no easy task for the 30 or more staff of the Central Unit in Geneva, and the Inter-regional Research Unit in Research Triangle Park, USA, and there is now a real need for those further afield to receive regular information on current publications, meetings and other significant events.

In 1989, the IPCS Programme Advisory Committee expressed strong support for a regular newsletter and noted a need to increase the communication among the Participating Institutions concerning their involvement in IPCS-related activities. Now that the necessary staff and financial resources are available, at least two issues will be produced yearly.

Among the readers of this the first IPCS newsletter will be those who already have a very good idea of the current IPCS activities and those who are not quite sure what IPCS stands for. Thus the newsletter attempts to walk the narrow tightrope between preaching to the converted and supplying a range of information for those who have little contact with the programme – a difficult compromise. Only through feedback to the Central Unit from readers will we know if that objective has been achieved. ◆

IPCS Staff Front row: *Mme H. Leblanc, Mrs A. Massy, Miss A. Catania, Mme G. Grand-Maison, Mr K. Uchida, Mme J. Duménil, Mrs H. Yasandikusuma, Mrs E. Ephraim, Miss T. Mawer*
Second row: *Mr D. Schutz, Dr C. Moreau, Mrs L. Akkerman, Dr B.H. Chen, Dr H. Galal-Gorchev, Miss H. Palmer, Miss E. Burt, Dr M. Mercier, Dr J. Haines, Dr J. Pronczuk de Garbino*
Back row: *Mrs P. Bartocci, Dr K. Jager, Dr P. Jenkins, Mr X. Lourduraj, Dr R. Plestina, Dr M. Gilbert,*
Dr E. Smith, Dr J. Herrman, Dr G. Becking

What is IPCS?

The International Programme on Chemical Safety, created in 1980, is a joint venture of the United Nations Environment Programme, the International Labour Organisation and the World Health Organization. Its main objective is to assess the risks to human health and the environment posed by chemicals, thus providing internationally evaluated scientific information on which countries can base their chemical safety measures.

Other aims of the IPCS are to develop, improve and validate methods for evaluating chemical hazards, to promote training programmes and research into mechanisms of the biological action of chemicals, to support national programmes for the prevention and treatment of poisoning and to strengthen the ability of countries to deal with emergencies involving chemicals.

Over 30 countries and national agencies collaborate in the work of the IPCS, along with many other international organizations. Professional associations dealing with chemical safety are consulted in implementing many of the IPCS activities. Specific activities are undertaken through a network of participating institutions, centres of excellence which carry out research into the effects of chemicals.

Inside

Chemical hazard communication: the need for harmonization

Consultations that took place during 1991 have led to progress in efforts to eliminate inconsistencies in chemical safety information

There is no shortage of information on chemical safety in the world of today. But does it reach the correct audience? Does the audience understand it? Is the audience confused by the fact that the same information about the same chemical is frequently expressed in several different ways? Getting the right message across - and accuracy is all-important when potentially toxic chemicals are concerned - is no easy matter considering the huge number of chemicals, the diversity of the audience and the important legal implications.

Adequate information about the characteristics of a chemical and the potential hazards associated with it must reach all those who deal with its manufacture, transport, distribution, use and disposal. Thus the audience can be broken down into several groups: the **professional users**, e.g. those who manufacture the chemical, both at the management and workforce level; the **services**, e.g. poison control centres, emergency responders; and the **public**, e.g. users of insecticides or herbicides in the garden.

Labels and documents

Clearly the needs and the level of understanding of these various groups are quite different. No one safety document could possibly suit their different requirements. The simplest type of information is the **label**. This needs enough information to prevent accidents or damage and must give a clear and immediate idea of the possible dangers. Then there is the **safety document** for use in agriculture, factories and other workplaces. This complements the information on the label and can be either a simple data sheet or a more detailed document. Finally there is the **criteria document**, which surveys and evaluates the whole wealth of scientific knowledge on a chemical.

Owing to the wide variety of information coming at present from many different sources, there is a distinct risk of inconsistency in the information supplied and of a duplication of effort. In addition the reader may well be confused by the different wording with which the same facts can be described. An ultimate aim might be to achieve complete identity of the systems of communication but this is unrealistic at present. In any case a unique system would probably be unwise in view of the diversity of the audience.

Standard phrases

One way in which greater consistency among safety documents can be achieved is by using **standard phrases**. This has the additional advantage of allowing both the generation and translation of safety documents to be computer-assisted. International consensus on a pool of such phrases has still to be achieved.

The IPCS has taken on the role of catalysing international discussions aimed at harmonizing the language used in safety documents. In addition, it has been collecting, in cooperation with a number of organizations and firms, standard phraseology used in the sections of safety document devoted to first aid, fire fighting, storage and handling, and acute toxicity. This material is now being analysed to identify cases where precisely the same hazard message is couched in different terms.

Once this process is completed, work will begin on the elimination of such discrepancies. The end result of this activity is that there will still be a variety of chemical safety documents, each adapted to the intended user, but at least the improvements to the phraseology should leave the user in no doubt of the precautions that he needs to

The various chemical safety documents

Material Safety Data Sheets are used in the USA and must be prepared by the manufacturer or importer of any hazardous chemical. They have a very wide audience which includes rank-and-file workers, plant safety engineers, occupational health professionals, emergency responders and community residents. A very similar system exists in Canada.

Safety Data Sheets exist in Europe, prepared again by the manufacturer or importer, and are intended for "professional users", i.e. industrial customers, rather than the public at large. Specifications exist concerning the type of information that must be supplied by employers to workers.

Chemical Safety Data Sheets are prepared for hazardous chemicals by the International Labour Office. This is a recommended list of headings which is similar to those used in international industrial organizations and European Community Directives.

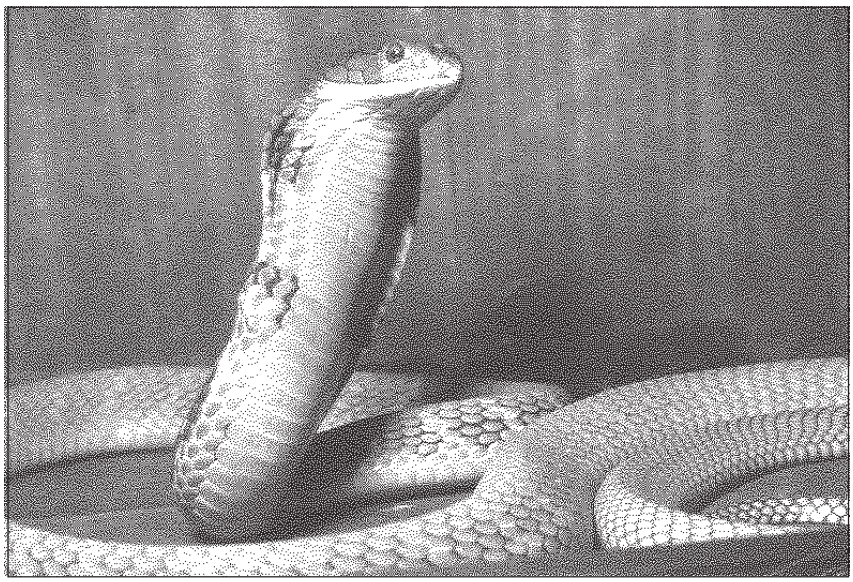
International Chemical Safety Cards present essential health and safety information for use at the "shop floor" level by workers and employers in factories, agriculture and other workplaces. They can also inform the public at large. They are prepared by the IPCS in cooperation with the Commission of the European Communities. The Cards differ from the other safety documents in that they are peer reviewed, they use standard phrases and they are not the result of a legal requirement.

Snakes, spiders and poisonous plants

The IPCS Natural Toxins Working Group, which forms part of the INTOX project, met for the second time in November 1991, the meeting being hosted by the Venom and Toxin Research Group of the National University of Singapore. One of the main purposes was to evaluate a series of Poison Information Monographs on poisonous plants and venomous animals. These monographs will eventually provide poison information centres with the data required in an emergency for diagnosis and patient management.

Among the venomous animals examined were scorpions, spiders and the highly dangerous snakes, e.g. mambas, death adders, puff adders, South American rattlesnakes and king cobras. The plants considered included broom and wisteria, both ornamental plants sometimes ingested accidentally by children, and the peyotl, a South American cactus used as a hallucinogenic.

An expert from the Royal Botanic Gardens, Kew, United Kingdom, provided assistance with plant classification, and discussions also took in the toxic effects produced by some herbal medicines.



King Cobra (Ophiophagus hannah). Reproduced from Snakes of Medical Importance by kind permission of the Venom and Toxin Group, National University of Singapore

During the meeting a training course on natural toxins, coordinated by Dr Jenny Pronczuk, was held, the topics including the recognition of poisonous plants and venomous animals, the management of bites, stings and poisonings, and the role of poison information centres in "toxinovigilance". It is intended to hold other training courses over the next few years on topics such as the prevention and treatment of poisoning by scorpions. ◆

Exposure limits

Defining exposure limits for chemicals, for the protection of human health and the environment is of major concern to all those involved in the risk assessment and risk management aspects of chemical safety at national and international levels.

The IPCS is not mandated to set standards but in its Environmental Health Criteria (EHC) monographs it assesses data relevant to the needs of agencies involved in the safety evaluation of chemicals and in setting exposure limits. The aim of a meeting held in January 1992 at WHO Headquarters was to advise the IPCS on ways of making environmental health criteria more useful to other agencies and assisting the WHO Task Groups that review and assess EHC data.

Guidance values

From this meeting came the recommendation that Task Groups use a systematic approach to the assessment of data and, where the data permit, derive Guidance Values. These are expressions of opinion by Task Groups and are values, such as concentrations in air or water, derived from the Tolerable Intakes (time to be specified) by the major routes of exposure and corrected by appropriate Uncertainty Factors. There was extensive discussion on the application of Uncertainty Factors and a "decision tree" approach was developed. For a given chemical there could be a number of Guidance Values for different toxic and ecotoxic effects and in various media and exposure situations.

The value of graphical presentations of data and Guidance Values to complement text was recognized. There will be further activity to develop graphics and to deal with other issues discussed, including data quality and reliability for risk assessment. ◆

The hazards of mercury

This unique metal with a long history of human use has been declared by the International Register for Potentially Toxic Chemicals to be one of the six most important toxic chemicals.

Man has been extracting mercury from the earth's crust for thousands of years. Long ago he realized that there were hazards associated with this valuable resource, and Pliny noted a particularly high death rate among mercury miners. There are substantial amounts of mercury in the environment as a result of natural emissions, e.g. from volcanoes. However, these levels have increased considerably as a result of industrial activities, such as mining, metal smelting, cement making, and the incineration of batteries and mercury-containing paints.

Mercury was chosen as the subject of the very first monograph in the IPCS Environmental Health Criteria (EHC) series, issued in 1976. Three new monographs on mercury have been published during the past three years: EHC 86 (1989) on environmental aspects, EHC 101 (1990) on methylmercury and EHC 118 (1991) on inorganic mercury.

Inorganic mercury

The evaluation of mercury toxicity is complicated by the differences between the major groups of mercury compounds. Metallic mercury is used in chemical manufacturing processes, in electrodes for certain electrolytic processes, in thermometer manufacture, in certain paints, in dental amalgam and in laboratory processes. Occupational exposure can occur in each of these situations, and there are problems of the pollution of the atmosphere, rivers and lakes. At high occupational exposure via inhalation, metallic mercury can produce effects on the nervous system, and on the kidney and skin after it has been converted in the body to inorganic mercury compounds.

Some inorganic mercury compounds have been used in the past for medical treatment, and they are currently found in certain paints and in skin-lightening soaps and cosmetics. Inorganic mercury compounds also occur as metabolites of organic mercury compounds that break down in the body or in the environment. The kidney and skin are the main target organs, but there are also indications that the menstrual cycle and fetal development can be affected.

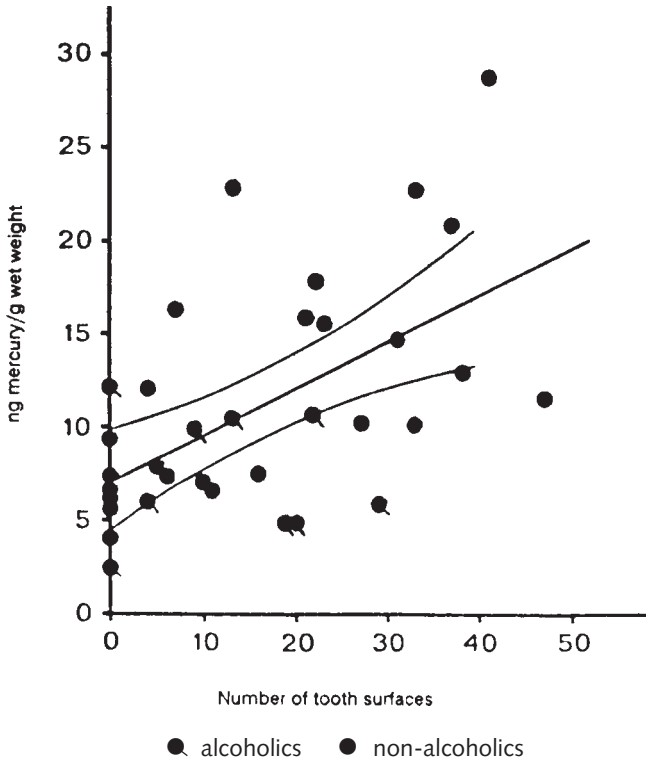
Methylmercury

Mercury is most toxic when it is converted, principally by microorganisms in the aquatic environment, to methylmercury. A disturbing recent finding is that this process accelerates when the acidity of a lake increases, a not unusual occurrence over the last few years.

Since methylmercury is very stable, it accumulates in the food chain and this leads to especially high levels in predatory fish. People who eat large quantities of these fish are therefore particularly at risk. This first occurred on a large scale during the 1950s and 1960s in Minamata, Japan. A more recent, though less serious poisoning outbreak occurred among Canadian Indians.

Methylmercury has effects on the central nervous system starting with loss of sensation in the fingers and constriction of the visual field. Higher exposure levels may lead to difficulties in walking, talking and hearing, and eventually result in

Fig. 1. Number of tooth surfaces containing amalgam in relation to total mercury concentrations in occipital lobe cortex



death. Methylmercury has been used to control fungal infections of seeds, although this is now banned in a number of countries. However, the use of such treated grain to prepare bread in rural communities in Iraq led during the early 1970s to poisoning on a wide scale and over 400 deaths.

Dental amalgam

EHC 101 and EHC 118 focus on the recent data that could affect the risk assessment, referring particularly to relationships between exposure levels and uptake into the critical organ and between exposure and response rates. In the case of metallic mercury and inorganic mercury compounds, occupational exposure is still the main concern, and recent data support WHO recommendations for maximum occupational exposure limits.

Of particular interest is exposure from dental amalgam. Fig. 1 (EHC 118, p 53) shows the relationship between the number of amalgam tooth surfaces and brain mercury levels at autopsy. Some mercury exposure is due to dental amalgam, but the levels in the brain are so low that only people with a special sensitivity to mercury could possibly be affected. Claims of individuals being affected have been made in some countries, but epidemiological studies have not confirmed the health effects.

As the skin effects of mercury compounds are due to an immunological reaction, it is possible that a small number of people develop an "allergy" to dental amalgam. On the other hand, dental amalgam has been used extremely widely and for many years with no apparent side effects of mercury poisoning. EHC 118 provides some new insight into this issue, but the available data do not show any clear link between the reported health effects and the use of dental amalgam.

Prenatal exposure

EHC 101 provides a detailed analysis of several recent studies on the dose-response relationship of methylmercury poisoning due to prenatal exposure. It had already been reported in EHC 1 that the fetus was the most sensitive individual for methylmercury poisoning and that exposure of pregnant women via food (usually fish) was of particular concern. Epidemiological studies in Iraq, Canada and New Zealand now show that there is a dose-response relationship between such exposure during pregnancy and delays in early childhood development.

Guideline levels

WHO has published a number of guidelines to encourage countries to take preventive actions against the different types of mercury poisoning. The recommended maximum levels in different media are listed in the table below. Most of the values given are levels of total mercury rather than of specific compounds, as for practical purposes this makes no difference.

Provided these guidelines are adhered to, it is very unlikely that poisoning will occur. Some uses of mercury compounds (e.g. methylmercury in fungicides and mercury compounds in soaps and cosmetics and in latex paints) have already been banned in certain countries and other countries may well follow suit. ◆

WHO guidelines for maximum levels of mercury and its compounds

Medium	Mercury species	Maximum level
Food[1]	total mercury	300 µg/week (PTWI)
	methylmercury	200 µg/week
Water[2]	total mercury	0.001 mg/litre
Air[3]		1 µg/m³ (indoor air)
Workplace[4]	mercury vapour	25 µg/m³ (TWA, long-term exposure)
	mercury vapour	500 µg/m³ (peaks, short-term exposure)

[1] *33rd JECFA Report, Technical Report Series 776, 1989*

[2] *Guidelines for drinking-water quality, 1984*

[3] *Air quality guidelines for Europe, 1987*

[4] *Recommended health-based limits in occupational exposure to heavy metals, Technical Report Series 647, 1980*

References

Environmental Health Criteria 86: Mercury - environmental aspects, 1989

Environmental Health Criteria 101: Methylmercury, 1990

Environmental Health Criteria 118: Inorganic mercury, 1991

A compact disc labelled "CC Info" and containing 15 Environmental Health Criteria monographs and 340 International Chemical Safety Cards has just been issued. It is obtainable from OSH Publications, Canadian Centre for Occupational Health and Safety, 250 Main Street East, Hamilton, Ontario L8N 1H6, Canada.

An intergovernmental mechanism for chemical risk assessment and management

The Preparatory Committee for the United Nations Conference on Environment and Development, due to take place in Rio de Janeiro, June 1992, has chosen the environmentally sound management of toxic chemicals as one of the subject areas, and stated that "the collaboration on chemical safety between UNEP, ILO and WHO in the IPCS should be the nucleus for international cooperation on environmentally sound management of toxic chemicals. All efforts should be made to strengthen this programme. Cooperation with other programmes, and particularly the OECD and EC chemicals programmes, should be promoted".

The UNCED Preparatory Committee also invited WHO, UNEP and ILO, within the framework of the IPCS, in cooperation with FAO and other relevant organizations, to report on ongoing work carried out through appropriate government expert meetings concerning possible proposals for an intergovernmental mechanism for chemical risk assessment and management. A meeting was convened by the Executive Director of UNEP and held in London from 15 to 19 December 1991 at the kind invitation of the government of the United Kingdom. These proposals were considered by experts from 71 countries and a number of international governmental and non-governmental organizations.

The meeting was a significant success, breaking new ground for improved international cooperation to achieve environmentally sound management of chemicals. It strongly endorsed the need for an intergovernmental forum and an enhanced role for the IPCS to include the coordination of risk assessment and risk management activities of international organizations and the support of the forum. ◆

IPCS welcomes Jenny Pronczuk

The most recent addition to the IPCS staff is Dr Jenny Pronczuk de Garbino, who joined us in July 1991 from Uruguay. She received her original medical training at the Universidad de la Republica in Montevideo, where she participated actively in the setting up of the Poison Control Centre (CIAT), inaugurated in 1975.

At the CIAT she was involved in the surveillance of the response activities, the treatment of poisonings, and training programmes. She obtained degrees in Clinical Toxicology in 1979 and in Occupational Health in 1984, and more recently became Vice-President of the Asociacion Latinoamericana de Toxicologia and of the Latin American Section of the World Federation of Poison Control Centres.

Before joining the IPCS, Dr Pronczuk was Associate Professor of Clinical Toxicology at the Hospital de Clinicas, School of Medicine, Montevideo, and Deputy Director of the CIAT. Already she was involved with the IPCS INTOX project, which aims at strengthening the capabilities for poison control, especially in developing countries. As a result, the CIAT became the pilot centre for the Spanish version of the Poison Information Package for Developing Countries.

In Geneva she is involved with the clinical side of IPCS publications and in preparing training material. However, her time is mostly taken up by INTOX-related activities, such as toxicovigilance, and the study of plant toxins is a natural extension of her keenness on plants and gardening. Her other interests are cycling and swimming, although the distinct lack of snow in Uruguay and overabundance in Switzerland are making her think seriously about sampling the delights of the ski slopes. ◆

Forthcoming Meetings

16-20 March 1992

Peer-review meeting on International Chemical Safety Cards, Carshalton, UK

23-27 March 1992

Working Group meeting on Principles for the assessment of health risks associated with chemical exposure, Carshalton, UK

6-10 April 1992

Workshop on Health effects of motor fuels and exhaust emissions, Canberra, Australia

9-18 June 1992

Fortieth meeting of the Joint FAO/WHO Expert Committee on Food Additives (JECFA), Geneva, Switzerland.
This meeting will be devoted to the evaluation of residues of veterinary drugs in food. Nine such drugs are on the agenda.

15-19 June 1992

Task Group meeting for the revision of WHO Guidelines for Drinking-Water Quality, Geneva, Switzerland

22-26 June 1992

Task Group meeting on Environmental Health Criteria for Polybrominated Biphenyls, Hanover, Germany

It should be noted that these meetings are being attended by specifically invited experts only.

Recent publications

Environmental Health Criteria

110 Tricresyl phosphate
111 Triphenyl phosphate
112 Tri-*n*-butyl phosphate
113 Fully halogenated chlorofluorocarbons
114 Dimethylformamide
115 2-Methoxyethanol, 2-ethoxyethanol and their salts
116 Tributyltin compounds
117 Methyl isobutyl ketone
118 Inorganic mercury
119 Principles and methods for the assessment of nephro toxicity associated with exposure to chemicals
120 Hexachlorocyclopentadiene
121 Aldicarb
122 *n*-Hexane
125 Platinum
126 Partially halogenated chlorofluorocarbons (methane derivatives)
128 Chlorobenzenes other than hexachlorobenzene

Health and Safety Guides

51 Paraquat
52 Diquat
53 Alpha- and beta-hexachlorocyclohexanes
54 Lindane
55 1,2-Dichloroethane
56 Hydrazine
57 Formaldehyde
58 Methyl isobutyl ketone
59 *n*-Hexane
60 Endrin
61 Isobenzan
62 Nickel, nickel carbonyl, and some nickel compounds
63 Hexachlorocyclopentadiene
64 Aldicarb
65 Fenitrothion
66 Trichlorfon
67 Acrolein

Unless stated otherwise, these publications are obtainable from the Office of Distribution and Sales, World Health Organization, 1211 Geneva 27, Switzerland. A brochure giving details of all Environmental Health Criteria monographs and a catalogue of reports issued by the Joint FAO/WHO Expert Committee on Food Additives (including an index of substances evaluated by JECFA since 1956) are both obtainable free of charge from the Office of Distribution and Sales.

Joint FAO/WHO Expert Committee on Food Additives (JECFA)

Toxicological evaluation of certain veterinary drug residues in food. WHO Food Additives Series, No. 27.

Evaluation of certain food additives and contaminants. 37th Report of the Joint FAO/WHO Expert Committee on Food Additives. WHO Technical Report Series, No. 806.

Toxicological evaluation of certain food additives and contaminants. WHO Food Additives Series, No. 28.

Evaluation of certain veterinary drug residues in food. 38th Report of the Joint FAO/WHO Expert Committee on Food Additives. WHO Technical Report Series, No. 815.

Joint FAO/WHO Meeting on Pesticide Residues (JMPR)

Pesticide residues in food - 1990 evaluations: Toxicology. World Health Organization, WHO/PCS/91.47, 1991.

Other publications

Safe use of pesticides. 14th Report of the WHO Expert Committee on Vector Biology and Control. WHO Technical Report Series No. 813.

International Chemical Safety Cards (CEC/IPCS). Second, third, fourth and fifth series (270 cards). Available from the Office for official publications of the European Communities, 2 Rue Mercier, L-2985 Luxembourg.

Immunotoxicity of metals and immunotoxicology. IPCS Joint Symposia, No. 15. ISBN 0-306-43679-5. Available from Plenum Press, 233 Spring Street, New York, NY 10013, USA.

Early indicators of non-genotoxic carcinogenesis. Proceedings of a Joint ECETOC/IPCS Workshop, Brussels, June 1990. Mutation Research Vol. 248, No. 2, 1991. Available from Elsevier Scientific Publishers B.V., P.O. Box 1527, 1000 BM Amsterdam, The Netherlands.

Mutagenicity of complex mixtures in Salmonella typhimurium. Report of the IPCS Collaborative Study. Mutation Research Vol. 276 Nos. 1/2, 1992. Available from Elsevier Scientific Publications, address above.

Safety and health in the use of agrochemicals: A guide. International Labour Organisation. Available from ILO Publications, International Labour Office, 1211 Geneva 22, Switzerland.

Prevention of major industrial accidents. International Labour Office. Available from ILO Publications, address above.

Myotoxins, endemic nephropathy and urinary tract tumours. International Agency for Research on Cancer. Available from IARC Scientific Publications, 150 Cours Albert Thomas, 69372 Lyon Cedex 08, France.

Distribution of monographs

It may take a month or two from the time that the first copy of a new Environ-mental Health Criteria monograph appears to the distribution of the final copy. So if you know that a particular monograph has just been published and are expecting to receive a copy, please be prepared for a short delay.

Expansion of pesticide activities

The IPCS produces a wealth of information related to the assessment and safe use of pesticides. This information comes from a variety of sources including the Joint FAO/WHO Meeting on Pesticide Residues (JMPR), Environmental Health Criteria monographs, Health and Safety Guides, International Chemical Safety Cards, the Expert Committee on the Safe Use of Pesticides, WHO/FAO Data Sheets on Pesticides, Poison Information Monographs, and the evaluation of pesticides as a component of the revision of the WHO Guidelines for Drinking-Water Quality. Some of these are cooperative activities with other international organizations, in most cases with the Food and Agriculture Organization (FAO).

These activities, some of which have been integrated within IPCS recently, have different origins within WHO; each has its own goals and coordination is often inadequate. For these reasons, work on pesticides within IPCS and between WHO and other organizations is not always carried out efficiently and there is occasional duplication of effort. In addition, some aspects of pesticide use and safety are not addressed. For example, JMPR investigates only residues in food; environmental effects and occupational exposure are not examined.

The IPCS is initiating an effort to consolidate its pesticide activities in cooperation with other international organizations and interested parties, although the mechanics have yet to be developed. By coordinating these activities to make them more efficient, resources will be conserved to pay at least in part for the expansion of activities. High priority will continue to be placed on pesticide residues in food because of the need for FAO and WHO to provide expert advice to the Codex Alimentarius Commission on their safety and maximum residue limits on food commodities.

Forthcoming publications

Environmental Health Criteria

123 Alpha- and beta-hexachlorocyclohexanes
124 Lindane
127 Acrolein
129 Isobenzan
130 Endrin
131 Diethylhexyl phthalate
132 Trichlorfon
133 Fenitrothion
134 Cadmium
135 Cadmium - environmental aspects

Health and Safety Guides

68 Polychlorinated biphenyls and terphenyls
69 Dimethylarsinic acid, methanearsonic acid, and their salts
70 Inorganic arsenic compounds other than arsine
71 Trimellitic anhydride

Joint FAO/WHO Expert Committee on Food Additives (JECFA)

Toxicological evaluation of certain veterinary drug residues in food. WHO Food Additive Series, No. 29.

Joint FAO/WHO Meeting on Pesticide Residues (JMPR)

Pesticide residues in food - 1991. Report of the Joint Meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and a WHO Expert Group on Pesticide Residues. FAO Plant Production and Protection Paper series.

Other publications

International Chemical Safety Cards (CEC/IPCS). Sixth, seventh and eighth series.

Handbook on poisonings

Manual of analytical epidemiology

Training module no. 1. Chemical safety: Fundamentals of applied toxicology; the nature of chemical hazards.

Summaries in French and Spanish

Readers with French or Spanish as their mother tongue should note that, although EHC monographs are not systematically translated into these two languages, the English version of each monograph carries translations of the Summary chapter into French and Spanish.

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