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IN THE 1980s

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MANAGING CHEMICALS

IN THE 1980s

Joanne K. Nichols and Peter J. Crawford

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Pursuant to article 1 of the Convention signed in Paris on 14th December, 1960, and which came into force on 30th September, 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development, and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations

The Signatories of the Convention on the OECD are Austria, Belgium, Canada, Denmark, France, the Federal Republic of Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States The following countries acceded subsequently to this Convention (the dates are those on which the instruments of accession were deposited) Japan (28th April, 1964), Finland (28th January, 1969), Australia (7th June, 1971) and New Zealand (29th May, 1973)

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PREFACE

Chemicals are indispensable to modern life. Perhaps more than any other single technology, chemical development has helped raise the standard of living to unprecedented heights. Yet, societies that depend on chemicals to maintain this standard are also troubled by the unintended effects of chemicals. This book is about the ways in which these countries are jointly seeking means to cope with the management of chemicals in the environment.

In recent years, governments have become involved in evaluating and managing the impacts of technology on society. In the case of production and use of chemicals, the need for effective management has been widely recognised and the government response has been to introduce legislation to protect man and the environment. To understand chemicals and chemistry is to understand much about pollution. At the same time, the social and economic importance of the chemical industry in industrialised countries is also appreciated. Thus, a variety of economic and social factors must be considered in the development of policies aimed at the control of chemicals in the environment.

The difficulties inherent in the management of chemicals, and the potential for countries to develop conflicting national policies that could result in economic and trade problems, has led to the emergence of a major international programme on chemicals in the Organisation for Economic Cooperation and Development. This programme has brought together hundreds of national experts from industry, government, academia and public interest groups to seek solutions to the many problems which could hinder effective chemicals management.

Over the years, extensive research and analysis of national material has been carried out in support of this programme. This work has contributed significantly to a better collective understanding of the state-of-the-art of chemicals management, and to the international harmonization of national policies for the management of chemicals.

The authors of this book have tried to set forth, concisely, the lessons learned, the progress made, and the international dimensions in managing chemicals in the environment. Until recently, they both worked in the OECD Chemicals Programme and have, therefore, been able to base their appraisals on intimate knowledge of that Programme. In this, they have been assisted by many colleagues from OECD Member countries and the OECD Secretariat, and for this reason, this book has been published on the responsibility of the Secretary-General of OECD.

The primary objectives of the book are three-fold:

i) to examine the international issues involved in attempts to manage chemicals in the environment;

ii) to describe the efforts of OECD Member countries to seek solutions to those issues jointly;

iii) to explore the ways in which the various aspects of management (scientific, information and economic) can be considered in a framework for taking decisions on chemicals.

The book is divided into three parts. Part I comprises three chapters which describe the state-of-the-art of chemicals management. Chapter 1 focusses on evolving industry/government/society relationships in the area of chemicals management over the past 20 years. Chapter 2 considers the scope and complexity of government responses to the need to take decisions on chemicals during this time. The passage from specific legislation to standards-based controls, to more general approaches to managing chemicals in the environment is traced. Chapter 3 describes the growing recognition of the need for international harmonization of chemicals management policies.

Part II describes in detail the OECD Chemicals Programme. Chapter 4 takes the reader through the early history and development of this Programme. The following three chapters outline the work carried out in each of the major areas of international study: the scientific, information, and economic aspects of chemicals management.

Despite progress in achieving international harmonization, formidable challenges remain to ensure effective management of chemicals. These arise especially in the context of two areas which are likely to preoccupy those engaged in international activity throughout the 1980s. These are the decision-making process and the evaluation of those chemicals already on the market. Part III of this book focusses on these two areas which underlie much of the current OECD Programme. The final chapter (10) draws together the strands in a conclusion.

Chemicals management is a complex task with a major international dimension. The OECD has encouraged and promoted the dialogue that is essential to success in achieving the aims of general chemicals management – that is, to protect man and the environment from potential adverse effects, while maintaining a vigorous international chemicals industry. In presenting the work that has resulted from this forum, it is hoped that this book will help to inform discussion and thereby contribute to extending consideration of these important issues to as broad a community as possible.

Part I

TOWARD MORE EFFECTIVE CONTROLS

Chapter 1

THE CHANGING ATTITUDE TO MANAGEMENT OF CHEMICALS

Technological innovation and development are cornerstones of modern societies. The post-World War II development of new and efficient materials raised the standard of living in industrialised nations to unparalleled heights. Economies boomed, working conditions improved, infant mortality rates dropped, suffering from disease was reduced. The chemicals industry contributed significantly to these changes with development of a vast array of substances and products on which industrial activity came to rely. Prosperous societies entered a "chemical" age with no end in sight to the expected benefits – from cleaner carpets and whiter teeth, to stronger building materials and better agricultural output.

However, scientific findings indicated that this rapid development was accompanied by a subtle threat to human health and the environment. Concerns about potential long-term and widespread effects raised questions about the impact of many technologies including the chemicals sector on the global environment. These discoveries and concerns helped to bring about changes in societies' values and expectations about the management and use of technology. The emergence of the environmental ethic of the late 1960s was thus accompanied by a call for re-evaluation of contemporary notions of progress. The limits to growth were considered, and the notion of "small is beautiful" aroused concern and debate.[1]*

The 1970s was a decade characterised by significant development in environmental protection in Western industrialised countries. Many countries established agencies or departments concerned primarily with environmental issues. Early legislative activity was aimed at providing and maintaining clean air and water, and at requiring greater understanding of and protection against the effects of pesticides and insecticides. More attention was also focussed on the need to protect workers in modern industrial activities. Occupational health and safety laws were formulated, reviewed or amended to mitigate contemporary health risks

A review of this legislation reveals increasing concern about chemicals. This is demonstrated by regulations steadily extended to cover more types of substances, and to ensure protection against more potential effects, including environmental insults. In the Member countries of the Organisation for Economic Co-operation and Development (OECD) many major legislative texts now address aspects of the control of chemicals from manufacture through handling and use to disposal.[2] More than half of these countries have passed laws aimed at the general control of all chemicals.

As public awareness and scientific understanding of potential hazards have increased, governments have tried to keep pace with legislative means to mitigate deleterious effects on society Evaluations of the efficacy of such measures are mixed.

* Figures between brackets refer to the notes and references at the end of this volume

On the one hand, they have resulted in more prudent handling and use of potentially dangerous substances and provided greater protection against threats to human health. On the other, there are circumstances where control actions have led to an exaggerated view of the significance of the hazards and to the inefficient use of resources to deal with them [3]

There is a strong link between heightened public awareness and this legislative activity. This awareness has resulted in greater demands for public accountability from decision makers in both industry and government. This, in turn, has led to new relationships between industry, government and the public in decision making processes Developments in chemicals management over the past 15 years reflect changes in the processes of modern decision-making.

Early Approaches to Health and Environment Protection

Control of chemicals in the environment has been limited for a number of reasons. One is found in the early fragmented regulatory approach. This was based on the need to deal with known hazards in recognised situations. The emphasis was on reactive and corrective measures. Responsibility for the implementation and supervision of these measures was fitted into the existing institutional arrangements. In the 1970s, various agencies and departments existed in most OECD countries for the protection of workers, public health, the health and safety of consumers and, later, the natural environment. Under these national arrangements emission standards, occupational health standards and product standards were established.

This fragmentary legislative approach inevitably resulted in gaps in understanding and in the control of overall effects. Because of the pervasive nature of many chemicals, exposure may be encountered in various or all environmental media. Thus, to examine effects or exposure in the context of only one medium may limit understanding of potential hazards and achieve only partial control of such hazards. Similarly, a number of populations or areas may be affected by a single chemical, *e.g.* workers, consumers and the environment. Consequently, strictly sectoral regulatory approaches involving worker protection, public health and consumer safety came to be viewed as inadequate. A need was foreseen in a number of countries for additional legislation to deal with potential risks from then unregulated chemicals, and to create a consistent and intersectoral mechanism for their control.

The Unanticipated Effects

Another reason why early legislative control measures resulted in incomplete health and environmental protection lay in the inadequate attention paid to chemicals which were not intended to impact on biological systems. Early legislation focussed on foreseeable hazards presented by such chemicals. But this has meant that scrutiny of chemicals prior to their entry onto the market has until very recently been limited to chemicals designed or intended to have a specific effect on some organism in the ecosystem (*e.g.* pesticides), or designed for ingestion by people (such as food additives and pharmaceuticals). For similar reasons, cosmetics as well as cleaning and hygiene products have also been subject to approval or classification in most OECD countries. Other chemicals used in the manufacture of consumer products were thought to have relatively minor effects on the environment and human health.

As monitoring and control techniques became more sophisticated, partly in response to standards set under early legislation, understanding of the spread of chemicals in the environment and their potential effects increased significantly

increased. Evidence began to emerge which implied that by focussing on the dramatic effects of industrial chemicals (resulting from explosions, for example), other unintended, and potentially serious environmental and health problems could be overlooked.

Beginning with the discovery in Japan, in 1956, of Minamata disease in Japan caused by exposure to high mercury concentrations the list of incidents involving chemicals continued to grow. Some of the other findings which have contributed to worldwide concern include:

- the detection of a high incidence of bladder cancer in rubber and cable industry workers;
- identification of PCBs and similar organochlorines in fish and wildlife species and in mothers' milk;
- revelations of cancer hazards associated with the use of vinyl chloride monomer in plastics production;
- problems in dealing with the release of polychlorinated dibenzodioxins to the environment;
- revelations of high levels of toxic substances in the environment due to inappropriate disposal of chemical wastes.

Each of these incidents involved chemicals that had entered production or the environment with inadequate safeguards due, in most instances, to a lack of understanding as to their long-term effects or persistency. The deleterious effects were usually unanticipated.

Of course, these chemicals are but a few of the many thousands which are in common use in modern industrialised societies today. Most substances pose no known risk to human health or the environment. But unanticipated problems of major proportions have arisen with respect to the manufacture, use and disposal of some. This fact coupled with the sheer number of the chemicals entering the environment and their increasing diversity of use, has indicated a need for more systematic and general controls.

In 1971, the US President's Council on Environmental Quality noted in a report on toxic substances: "Our awareness of environmental threats, our ability to screen and test substances for adverse effects, and our capability to monitor and predict ... are sufficiently developed that we need no longer remain in a purely reactive posture with respect to toxic substances. We should no longer be limited to repairing the damage after it has been done, nor should we continue to allow the entire population or the entire environment to be used as a laboratory."[4]. By 1974, two OECD countries (Switzerland and Japan) had initiated regulations aimed at the general control of chemicals with a view to pre-market screening, and consideration of similar legislation was underway by other national governments.[5]

PCBs: A Catalyst for New Initiatives

From what has been said before, it is clear that international concern about the problems of chemicals in the environment evolved from concern about individual known hazardous substances. The case of polychlorinated biphenyls (PCBs) [6] is illustrative of this point. National attempts to control PCBs increased awareness of the need for broader scrutiny of industrial chemicals, and provided impetus to the development of a new generation of legislation aimed at the general control of chemicals.

PCBs were introduced in the late 1920s. Because of their unique array of qualities including low flammability and high specific heat capacity many uses were found for the compounds. The main use is in transformers and capacitors. They have also been used as

heat transfer fluids, hydraulic fluids, plasticizers, vacuum pump fluids, and in lubricating and cutting oils. Given the many and varied uses of PCBs, it is not surprising that there are a number of pathways through which they reach the environment, including industrial discharges, leaching of contaminated soil or inappropriate waste disposal, as well as through food chains.[7]

The presence of PCBs in the physical environment was not detected until the 1960s. A Swedish researcher was measuring levels of chlorinated pesticides in human fat and in wildlife for the Royal Swedish Commission on Natural Resources when he discovered a compound for which he could find no reference in the pesticide literature. Further research allowed him to identify it as of the PCB group. Jensen published his confirmed findings in *The New Scientist* in 1966.[8]

Soon, scientists in other countries began investigating the presence of PCBs in the environment. The evidence produced was not encouraging. By 1972, it was apparent that PCBs were widely distributed in the biosphere. Their persistence and accumulation in the environment raised serious international concern. The result of dispersal has led to significant environmental pollution (particularly of the marine environment). In some cases, serious acute health effects were also encountered.[9] Today, PCBs are recognised as one of the most widespread chemical contaminants known to man.

Assessment of the potential long-term effects of PCBs on human health and the environment is a complicated task. There are several reasons for this. One is the large number of chemicals comprising the PCB group and the different toxicities of these compounds. Another is the presence of other toxic impurities in commercial mixtures of PCBs. Evidence of effects derives mainly from animal studies. However, one major accident involving PCBs in Japan[10] and some occupational studies have indicated some effects of human exposure.

Concern about the spread of PCBs led a number of countries to take action to curb their production and use.[11] By 1972 five of the six companies manufacturing PCBs in OECD countries had taken steps to restrict supply to a few approved uses.[12] Adequate regulation often proved a complex task. Various legal and regulatory instruments were necessary In some cases, control required the involvement of various agencies at the national level, as well as regulatory bodies at the regional and local levels. Authority to reduce emissions by application of measures to control release into the air and water was clearly insufficient. Since they could not be categorised as a pesticide or other biologically active chemical, PCBs could not be controlled by legislation aimed at those categories of chemicals. The problem of control was compounded by the wide trade in PCBs and PCB containing products. Neither the use nor the effects of PCBs are confined by national boundaries

Given the scope of the problem and growing awareness of other unregulated hazardous substances, it is understandable that governments turned to international forums to gain better understanding of the problems at hand and to work toward mutual solutions for their control.

International discussions on the PCB problem were held within OECD and a report was prepared on "Polychlorinated Biphenyls, Their Use and Control".[13] This resulted in the OECD Council Decision in 1973 binding OECD countries to limit the use of PCBs to certain closed systems, and to provide that measures to control bulk PCBs and PCB containing products be applied.[14]

This Decision was the first attempt to control through internationally concerted action, the environmental hazards associated with a specific chemical. The Decision was designed to minimise and ultimately eliminate environmental damage from PCBs. It also provided for an information exchange mechanism in order to review progress in Member countries to implement the Decision, and to share national experiences in coping with the PCB problem.

By 1979 PCB production in OECD countries had decreased significantly. According to a recent Organisation report, the potential for their escape into the environment has been markedly reduced.[15]

Although some national actions were taken before the Council Decision, the OECD effort clearly demonstrated the value of internationally co-ordinated efforts with respect to the control of chemicals. The OECD Decision provided a framework within which national control actions could be taken. Moreover, the experience gained from the exchange of information on PCBs helped to create a forum for discussions on continuing issues related to the control of chemicals. These include, inter alia, the problems of chemical waste disposal and the transport of hazardous wastes across national frontiers.

The PCB issue acted as a catalyst for broader chemical control initiatives in three key aspects:

First: it increased concern about the ubiquitous spread of industrial chemicals in the environment;

Second: it highlighted the need for more effective regulations to assist government in dealing with problems associated with chemicals entering the environment; and

Third: it gave rise to recognition of the inherently international aspects of the control of chemicals.

Thus, following its work on PCBs and other individual chemicals, OECD began to turn its attention to the broader issue of the general control of chemicals and to the need for a more predictive approach. Early discussions were in part motivated by recognition that a changing regulatory climate would have an impact on the international chemicals industry. Specifically, concern was expressed that widely differing legislative approaches could result in economic distortions and trade disruptions.

The Chemical Industry in an Evolving Social Climate

With this concern in mind an early appreciation of the chemical industry and its role in industrialised societies is essential. The chemical industry is one that is characterised as dynamic innovative and highly competitive. Two-thirds of the world's industrial chemicals are produced in OECD countries. The sale of chemicals alone amount to more than US$450 billion annually. The industry accounts for about 10 per cent of manufacturing output and 2.5-3 per cent of Gross Domestic Product (GDP) in OECD countries.[16]

International trade in chemicals is sizeable, and significant to national economies. For example, chemicals alone accounted for US$138 billion of all OECD exports and $103 billion of OECD imports in 1980.

About four million people are employed by the industry in OECD countries. Many of them work for firms that employ less than 100 people. Yet 30 percent of the non-communist world's chemical sales are generated by only 25 firms. In recent decades, the industry has grown at twice the rate of the manufacturing sector in general

Growth in the industry has been characterised by the development of new products and processes which contribute significantly to growth in other industrial sectors.[17] New chemical products range from fabrics, medicines, preservatives and dyes to building materials and machine parts. There are, in fact, few industries that are not served by chemicals [18], and virtually every facet of life in industrialised societies has been touched and, in many ways improved by chemicals.

It is, in fact, difficult to say just where the chemical industry ends and another industry begins.[19] A number of major chemical producers, for example, are not