PB95-260683

POLICIES, PROGRAMS, AND PUBLIC PARTICIPATION: ENVIRONMENTAL AND OCCUPATIONAL HEALTH IN THE EMERGING MARKET ECONOMIES AND DEMOCRACIES OF CENTRAL AND EASTERN EUROPE

MANAGEMENT SCIENCES FOR HEALTH, INC., BOSTON, MA

1993

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

50272-101

PB95-260683

REPORT DOCUMENTATION PAGE	1. REPORT NO.	2.	

4. Title and Subtitle Policies, Programs, and Public Participation: Environmental and Occupational Health in the Emerging Market Economies and Democracies of Central and Eastern Europe. Edited Proceedings of the Third Annual Symposium on Environmental and

5. Report Date 1993/00/00

6.

7. Author(s) Levy, B. S., and C. Levenstein, Eds.

8. Performing Organization Rept. No.

9. Performing Organization Name and Address Management Sciences for Health

10. Project/Task/Work Unit No.

11. Contract (C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address

13. Type of Report & Period Covered

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words) This report focuses on material presented at the Third Annual Symposium. The topics considered at this conference included policies and programs in Poland, in other countries in Europe, and in the United States; market economies and democratic political systems including reports on market forces and environmental health, and public participation, democracy in action; methods and applications; studies of environmental contamination and health; and studies of social factors and health. Based on the information given at the conference, the general conclusions were that there is a need to establish new working relationships and strengthen existing ones, to develop and provide educational and informational programs and materials, to find ways to balance environmental protection and economic development, to strengthen democratic institutions and processes, and to undertake new policy initiatives.

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms NIOSH-Publication, NIOSH-Grant, Worker-health, Safety-programs, Safety-research, Accident-analysis, Accident-prevention, Industrial-health-programs, Occupational-health-programs, Environmental-exposure

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages 320
	20. Security Class (This Page)	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272(4-77) (Formerly NTIS-35) Department of Commerce

PB95-260683

POLICIES, PROGRAMS, AND PUBLIC PARTICIPATION: Environmental and Occupational Health in the Emerging Market Economies and Democracies of Central and Eastern Europe

Edited Proceedings of the Third Annual Symposium on Environmental and Occupational Health during Societal Transition in Central and Eastern Europe
Pułtusk, Poland, June 26 - July 1, 1992

Edited by Barry S. Levy and Charles Levenstein

The United States - Central and Eastern Europe Exchange
for Environmental and Occupational Health
Management Sciences for Health
Boston, Massachusetts, USA

in cooperation with
Tufts University School of Medicine
University of Massachusetts Lowell

MSH MANAGEMENT SCIENCES FOR HEALTH

POLICIES, PROGRAMS, AND PUBLIC PARTICIPATION: Environmental and Occupational Health in the Emerging Market Economies and Democracies of Central and Eastern Europe

Edited Proceedings of the Third Annual Symposium on Environmental and Occupational Health during Societal Transition in Central and Eastern Europe Pułtusk, Poland, June 26 - July 1, 1992

Edited by Barry S. Levy and Charles Levenstein

The United States - Central and Eastern Europe Exchange
for Environmental and Occupational Health
Management Sciences for Health
Boston, Massachusetts, USA

in cooperation with
Tufts University School of Medicine
and University of Massachusetts Lowell

This symposium was financially supported by the Regional Environmental Center for Central and Eastern Europe, the National Institute of Environmental Health Sciences, and the United States Committee On Poland's Environment (U.S.COPE).

Organizing institutions of the symposium were Management Sciences for Health, the Institute of Social Medicine of Warsaw Medical School, and the National Center for Health System Management of Poland.

The development of these proceedings was financially supported by the National Institute for Occupational Safety and Health.

MSH MANAGEMENT SCIENCES FOR HEALTH

SYMPOSIUM PLANNING COMMITTEE

Henryk Kirschner, Co-chair
Barry Levy, Co-chair

Halina Brown
Barbara Felitti
Jerzy Karski
Cezary Korczak
Irene Kosinska
Boleslaw Krzysztofik
Charles Levenstein
Joan Parker
Kathleen Rest
Jan Sobótka
Eve Spangler
Marsha Spitzer
Allen White

COLLABORATING INSTITUTIONS

Poland

Central Institute for Labor Protection, Warsaw
Copernicus Medical Academy, Krakow
Foundation Eco Development-2100, Warsaw
Foundation of Ecological Education, Warsaw
Ministry of Environmental Protection, Natural Resources, and Forestry, Warsaw
Ministry of Health and Social Welfare, Warsaw
Ministry of Labor and Social Affairs, Warsaw
National Labor Inspectorate, Warsaw
Nofer Institute of Occupational Medicine, Łodz
Polish Ecological Club, Krakow
Polish Society of Hygiene, Warsaw

Denmark

Euro Health Group, Copenhagen
Regional Office for Europe, World Health Organization, Copenhagen

United States

Department of Sociology, Boston College, Chestnut Hill, Massachusetts
Center for Technology, Environment, and Development, Clark University, Worcester, Massachusetts
Harvard Education Resource Center in Occupational Safety and Health, Boston, Massachusetts
Tellus Institute, Boston, Massachusetts
Department of Work Environment, University of Massachusetts Lowell, Lowell, Massachusetts
Department of Family and Community Medicine, University of Massachusetts, Worcester, Massachusetts

Printed on recycled paper.

CONTENTS

PART ONE: POLICIES AND PROGRAMS

SECTION ONE: POLAND

SECTION TWO: OTHER COUNTRIES IN EUROPE

SECTION THREE: UNITED STATES

Oil Refinery at Płock

PART THREE: METHODS AND APPLICATIONS

SECTION SIX: METHODOLOGICAL APPROACHES

Photographs by Barry Levy

FOREWORD

PUBLIC POLICY IN ENVIRONMENTAL AND OCCUPATIONAL HEALTH: A CRITICAL AMERICAN PERSPECTIVE

Charles Levenstein
University of Massachusetts Lowell
Lowell, Massachusetts, USA

This book is based on the Third Annual Symposium on Environmental and Occupational Health during Societal Transition in Central and Eastern Europe. In the first two meetings, we American participants were impressed by the scientific work that had been performed by our European colleagues during extremely difficult times. On the other hand, we were also struck by the gap between sophisticated science and the actual industrial-environmental practices of former Communist states. The separation between policy and program development, on the one hand, and implementation and science, on the other, was stark. Further, we were concerned because many of our colleagues had fond hopes that the transition to market economics would somehow automatically result in more rational environmental practices without public intervention. Perhaps the most urgent message that we Americans brought to the first two symposia was that the cultivation of democracy and the development of civil society—including participation by scientists in the public sphere—was the main hope for improving the health of workers, citizens, and the environment. We urged that science and scientists be involved in policy development and action in the interest of public health. To our chagrin, we discovered that there was no word for "policy" in any of the languages of our Central and Eastern European colleagues.

What is Policy?

Out of these discussions and consequent insights emerged the proposal by the Americans that this symposium focus on "policy," and the suggestion was accepted graciously by our Polish hosts. (Perhaps they were indulging these strange Americans.) Since my profession is the teaching of general and work environment policy, I agreed to take on the role of explaining what Americans meant by "policy." By way of preparation for this talk, I reviewed a number of recent works on public policy, and in my remarks I am relying heavily on C.S. Bullock et al., ***Public Policy in the Eighties*** (1). This work seemed to me a reasonable example of the policy discussion in the United States.

Public Policy

According to Bullock, public policy most generally is a governmental course of action intended to deal with a problem or matter of concern. It is developed by governmental institutions, such as parliaments and executive agencies, through the political process—that is, through *politics*. Note that public policies in these discussions are purposive; they do not "just happen." They are courses of action, not separate, discrete activities. They may be positive or negative: the government in a given situation may decide not to act. Public policies are based on law and are "legitimate."

The first stage in the policy process is problem formation. This is a political process in which a problem is recognized by some portion of the public, which then seeks relief from the parties deemed responsible for the situation and/or from the government. The recognition of an occupational or environmental disease by workers or citizens (or scientists) and the subsequent demands for environmental controls are an example of problem formation.

As Bullock puts it, the second stage is "Getting the government to begin to act on the problem," that is, getting the issue of concern onto the public policy agenda. Recognition of a problem, the first stage, may be met with denial, fatalism, or serious attention; only the last of these responses indicates that the government is prepared to address this issue among the many it faces.

The third stage of the policy process involves the design of solutions to the problem, which may include posing alternative approaches by interested parties inside and outside government. This stage may appear to be "technical," but critical (and alternative) assumptions may be made that constrain possible solutions. For citizens to understand the alternative proposals that may be advanced, it may be necessary for their groups to have technical, including economic, advice from friendly experts.

The fourth stage is clearly political: getting the government to adopt a particular solution. Bullock describes this state as the "development of support for a specific proposal such that a policy is legitimized or authorized." In environmental and occupational health, the adoption of particular scientific and technological policies requires the close cooperation between technical experts and decision-makers. Few citizens, including legislators, are equipped to understand the full implications of their decisions without friendly technical assistance.

The fifth stage of the process, following formal adoption of policy by the government, is policy implementation. This is in accordance with the notion that policy is a course of action, not simply a statement of intent. In occupational and environmental health, implementation is key, of course, because the government will frequently give broad mandates to executive or administrative agencies which must then develop and enforce specific standards or regulations. As the old proverb puts it, "There's many a slip between spoon and the lip." Budgetary considerations are fundamental to implementation, in both standards development and enforcement. Politics continues to operate in standard-setting, with interest groups playing sometimes direct, sometimes more subtle, roles.

Finally, policy analysts insist that policy evaluation is an essential part of the process. Scientific, quasi-scientific, and unabashedly political approaches are used in evaluation. Perhaps the most remarkable aspect of policy analysis is the presumption by the analyst that the written policy represents the true statement of goals of public policy, when it is abundantly clear that political compromise and scientific uncertainty are likely to produce deeply flawed programs.

Coherence in Public Policy

When I agreed to make these remarks, my colleague Dr. Levy suggested that I present to the conference concrete examples of occupational or environmental health policy from our experience in the United States. I took this suggestion to heart and, after reviewing the policy literature, found myself in the embarrassing situation of being unable to provide an example from occupational health policy, which is the area of my expertise. How could this be? Charles Noble, author of *Liberalism at Work*, an insightful critique of the Occupational Safety and Health Act and the Occupational Safety and Health Administration in the U.S., describes the fundamental dilemma of policy development in the American scene: "The United States is so deeply fragmented politically and economically that it is virtually inconceivable that coherent work environment policy can emerge. The political divisions—separate legislative, executive, and judicial branches at federal, state, and local levels—as well as the enormous number of economic enterprises, most of which employ 20 or fewer people, are well-designed to prevent the systematic development of national policy. We do not have effective "peak" organizations representing labor, management, and government that can negotiate a national framework for work environment policy. At all levels, special interests can intervene to block positive policy-making. And, certainly, the enormous number of enterprises makes effective policing by the state inconceivable.

Rather than "policy," then, we in the United States have "politics." Perhaps in unitary states or more highly organized ones, policy can develop in the way the political scientists and policy analysts hope. But, I suspect, this is a very British or North European conception, complete with a king or queen. In the rather more disorderly process of politics, the role of science is important as it relates to the variety of political and economic forces interested in the particulars of regulation. Perhaps detailing the politics of environmental health would be more relevant to the states of Central and Eastern Europe with their emerging civil societies.

REFERENCE

1. Bullock, C.S., Anderson, J.E., and Brady, D.W., 1983. Public Policy in the Eighties. Monterey, CA: Brooks-Cole Publications.

Symposium participants pose outside the conference site.

PREFACE

The societal transition affecting the nations of Central and Eastern Europe is having profound effects on many aspects of health and the environment, including environmental and occupational health. The emerging market economies and democracies in this region present both challenges and opportunities for the recognition, assessment, treatment, and, most importantly, prevention and control of disorders caused by factors in the general environment and in the workplace.

The symposium on which this publication is based, the Third Annual Symposium on Environmental and Occupational Health during Societal Transition in Central and Eastern Europe, examined these challenges and opportunities from many perspectives. It brought together over 100 scientists, government policy-makers, representatives of nongovernmental organizations, and others for presentation and discussion of information on policies, programs, and public participation regarding environmental and occupational health. They met for five days in Pułtusk, Poland, presenting and discussing environmental and occupational health problems in their own countries and possible solutions to these problems. They participated in a role play that raised important environmental and occupational health issues. And they visited a huge oil refinery in Płock. Out of this symposium came new information, a better understanding of problems and issues, close professional contacts, and renewed enthusiasm and empowerment for these individuals and their institutions to face the challenges of environmental and occupational health.

Essential for effective environmental and occupational health is the translation of science into policy and action. This translation represents a particular challenge for the nations of Central and Eastern Europe because scientists in these nations generally have had little previous experience in affecting policy and action. governmental and nongovernmental organizations have had little previous experience in trying to use scientific information on which to base policy and action, and even the concept of "policy," as it is usually defined in Western countries, has not been defined or applied in these nations before.

Improving environmental and occupational health in the nations of Central and Eastern Europe and elsewhere will not be easy. However, with internationally shared understandings and partnerships, problems can be addressed more effectively. This symposium represents one more step toward these understandings and partnerships.

Barry Levy
Charles Levenstein

Boston, Massachusetts, USA
April 1993

ACKNOWLEDGEMENTS

Presenting an international symposium and developing a book based on it requires the commitment and cooperation of many individuals. We acknowledge the following individuals and organizations for their outstanding work and partnership:

The organizing and co-sponsoring institutions that are listed in the front of this book;

Joanne Tighe for assisting with the development and editing of these proceedings;

Corinne Nagy and Alden Detwiler for assisting with the production of these proceedings;

Marsha Spitzer for assisting in the planning and presentation of the symposium;

Alan Yost for assisting with graphic design of these proceedings;

Stephen Wassersug and Jerzy Radziwill of the Regional Environmental Center for Central and Eastern Europe, Terri Damstra of the National Institute of Environmental Health Sciences, Jerry Wesolowski and Janusz Bajsarowicz of the United States Committee On Poland's Environment, and Greg Wagner of the National Institute for Occupational Safety and Health for facilitating financial support of the symposium and the proceedings by their organizations;

Irene Kosinska for her administrative and logistical support before and during the symposium;

Helga Rippen for presenting and Barbara Felitti for assisting with a workshop for speakers at this symposium;

Candy Roosevelt and Ron O'Connor of Management Sciences for Health for their advice and encouragement; and

Nancy, Laura, and Ben Levy and Ellen Loeb for their continuing support.

Finally, we express our deep appreciation to Henryk Kirschner and his colleagues Jerzy Karski, Cezary Korczak, and Jan Sobótka for their partnership and excellent work in organizing and planning the symposium.

Barry Levy
Charles Levenstein

IN MEMORIAM

Mátyás Börzsönyi

Ladislav Ulrich

National Institute of Hygiene
Budapest, Hungary

Institute of Preventive and Clinical Medicine
Bratislava, Slovakia

We dedicate this publication to the memory of these two leading scientists, who played important roles in the first two symposia on environmental and occupational health during societal transition in Central and Eastern Europe, and made many important contributions to environmental health by performing research and by helping to train the scientists of tomorrow.

PART ONE: POLICIES AND PROGRAMS

SECTION ONE: POLAND

Top row: Henryk Kirschner, Andrzej Skowroński, Janusz Indulski, and Tadeusz Sulkowski.
Bottom row: Maria Konarska, Jan Rzepecki, and Dariusz Ulatowski.

POLAND: BETWEEN THE PAST AND THE FUTURE

Henryk Kirschner
Institute for Social Medicine
Warsaw Medical School
Warsaw, Poland

This time of transition in Poland, following the Communist system's collapse 3 years ago, is more difficult than it seemed to be at first. Some Polish problems are common to many Eastern and Central European countries; other problems are local in character and result from historical and contemporary psychosocial factors. In order to understand what is happening now, it is necessary to perform an honest analysis of the last 50 years of our country's history.

Poland has a significant cultural heritage that has enriched mankind. But it has never been a flourishing country. It has been destroyed in many ways over the years—not only by Communists in the last few decades.

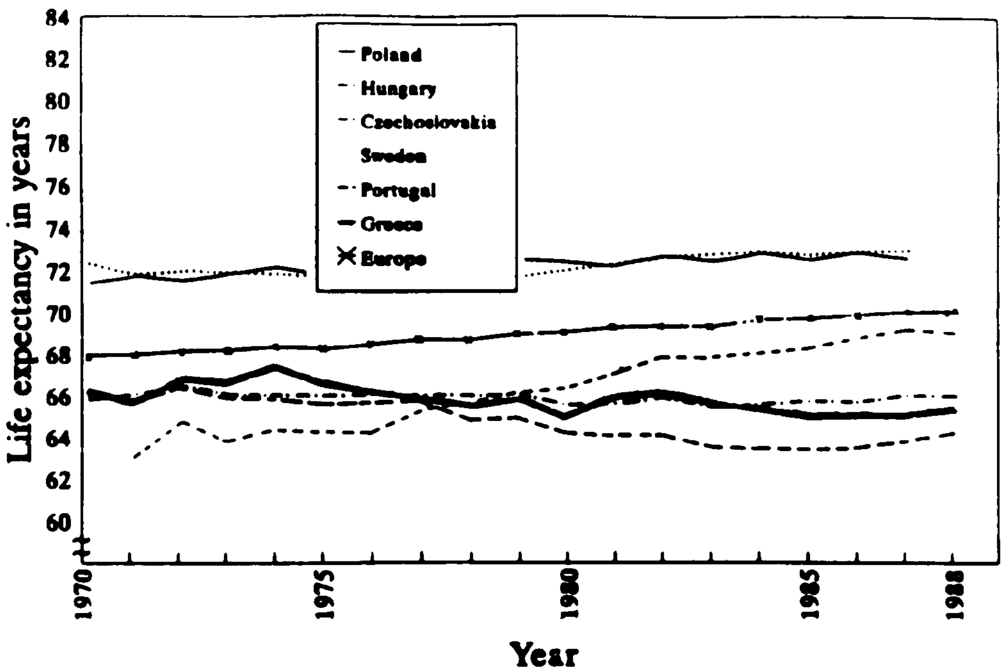
Division of Europe, in terms of level of development, has existed for ages. Poland, being situated between Russia and Germany, demarcated the line of the division. It has been the place of meeting of two worlds: the world of Western civilization with its technical maturity, and the East with its load of contradictions. The European unification process has never been easy. The division of Europe into two separate parts resulted from World War II, when the division of Europe represented the confrontation of two ideological systems. Common sense, however, won out and nuclear war was avoided. As the world heaved a sigh of relief, Europe began to overcome the existing division.

The astonishing changes in Western countries during the past 50 years have resulted from unusual technical progress. One reason for this progress has been cooperation among Western countries, in order to counterbalance the military threat of the Soviet Union.

What happened to the Central and Eastern European countries during this period under the influence of the Soviet Union? Before we answer this question, we must remember that just after World War II the Communist ideology had significant attractive power, even in some Western countries. After Nazism, the totalitarian nature of Communism was not so bad. Communist ideology used international slogans, supported liberation of colonial nations, and proclaimed principles of social equality. For the nations of Central and Eastern Europe, which were exhausted by World War II, Communism became the only social reality for many years. These countries were forced to join the grand social experiment based on Marxism. In Poland, however, there were major difficulties for its inclusion into the Communist bloc.

As a result of the war, Poland had large human and substantive losses. Reconstruction mobilized the people and this supported the Communists. Full employment, along with low wages and a strictly regulated economy, led to development, even with a lack of capital. Poland, like other

Figure 1: Life expectancy at birth in men



Source

Figures 1-4: Department of Medical Statistics, National Institute of Hygiene, Warsaw

The main causes of death in Poland are about the same as in other developed countries. About half of all deaths are due to cardiovascular disease, about 18 percent from malignancies, and about 8 percent from external causes. The standardized mortality rates from the same causes are, however, higher than those of other European countries. (Figures 2 to 4 show data for Polish men.) The mortality rate due to myocardial infarction is rapidly increasing in Poland; during the past 25 to 30 years, it has risen over six-fold. Communicable disease, including tuberculosis, accounts for about 1 percent of all deaths. Although the main health problems in Poland are "diseases of civilization," such as coronary artery disease and cancer, infectious diseases are still present—at rates higher than in the West.

Decisions by central authorities concerning industrialization and urbanization changed Poland from an agricultural country into a semi-industrialized one. At present, 62 percent of the Polish population lives in urban areas. Some of these changes were not economically sound. They produced giant industrial plants with outdated technology that was ecologically harmful. Bad economic decisions adversely affected the environment. New settlements and towns very often have not been good places for a healthy life. People living in rural areas, in spite of inadequate sanitary conditions, have a life expectancy that is longer that those in settlements and towns.

Figure 2: Standardized mortality rate from cardiovascular diseases, men

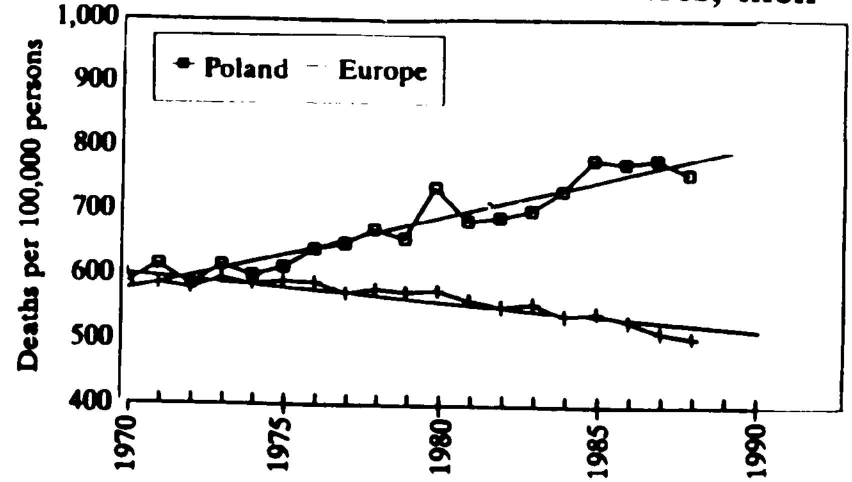


Figure 3: Standardized mortality rate from cancer, men

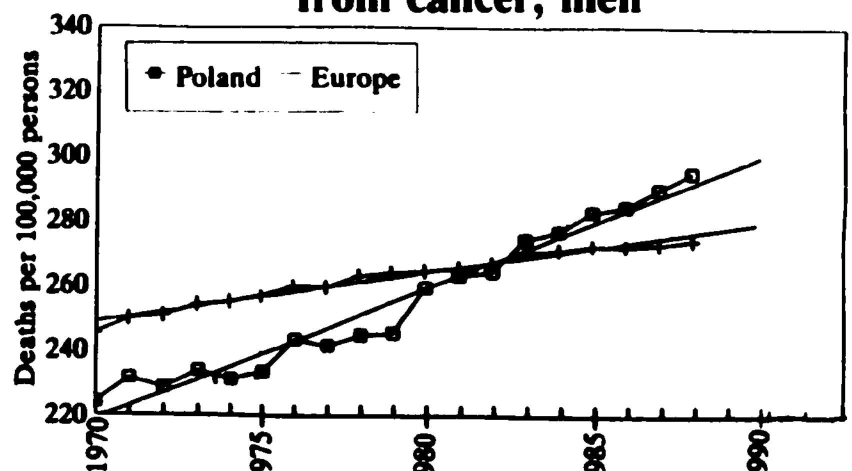


Figure 4: Standardized mortality rate from traffic accidents, men

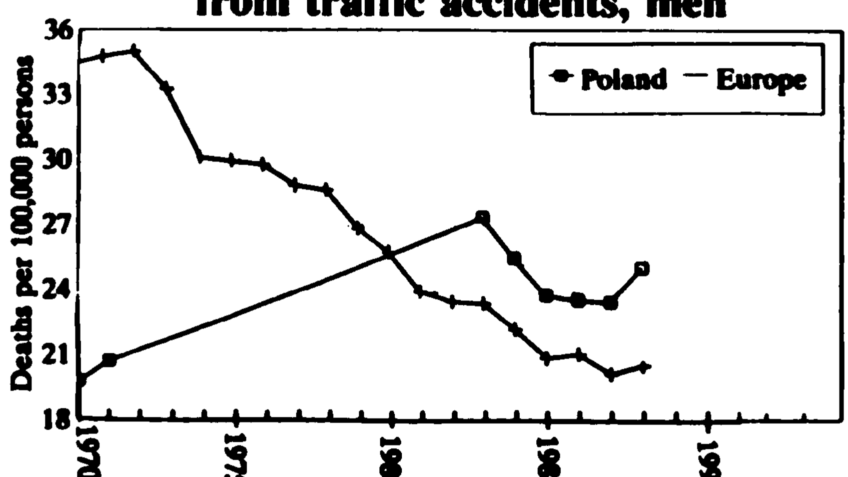
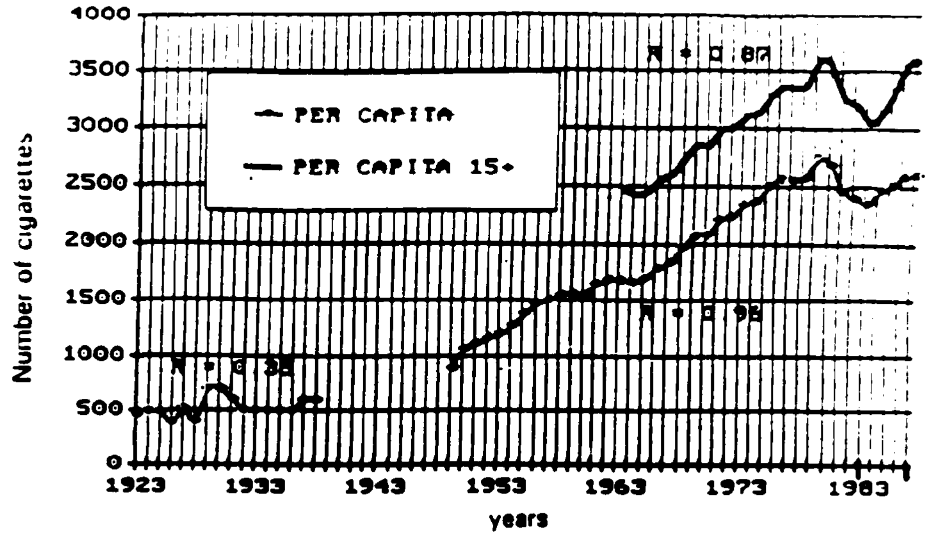


Figure 5: Cigarette consumption in Poland, 1923 - 1987



When considering the factors that affect health, one should consider the GNP. In Poland, this is very low for a moderately developed country. Unfortunately, significant efforts to attract investment have not resulted in as much economic success as was hoped for. Consequently, living conditions are fairly difficult. For example, housing is frequently overcrowded in cities. One-third of the urban population lives in flats in which three or more persons occupy one room. The housing shortage is one of the most important problems in the country.

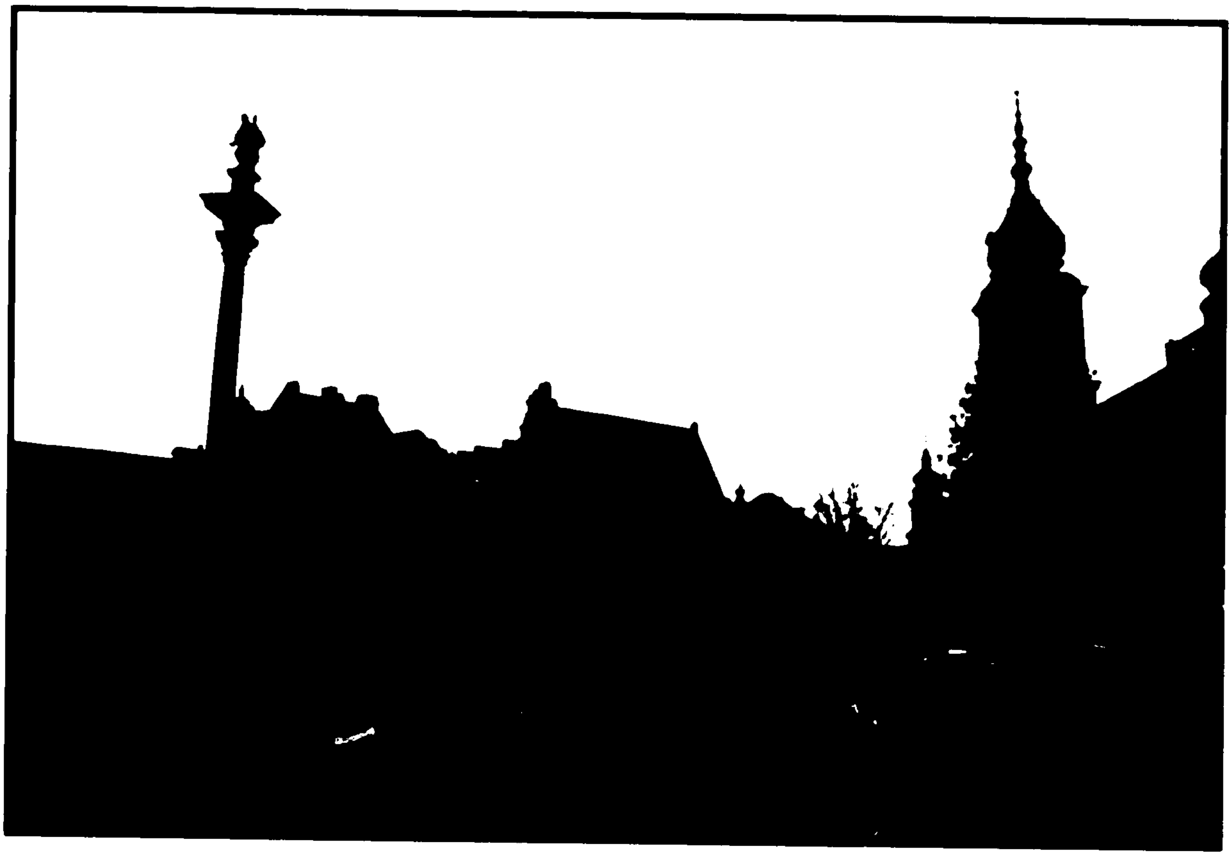
Development in Poland in the past 30 to 40 years has created some negative environmental and social factors that have led to unhealthy lifestyles, similar to those in Western countries. External factors, such as social and physical conditions that are out of people's control, undoubtedly resulted in poor health, but poor health has also resulted from lifestyles that have accompanied somewhat better living conditions. For example, people eat too many calories and become overweight. The composition of the diet has changed to include more animal fat and less carbohydrate. Between the early 1950s and the 1970s, consumption of animal fat doubled.

Another problem is smoking. A high percentage of adults in Poland smoke. Figure 5 shows increased tobacco consumption between 1923 and 1987. Cigarette smoking has been associated with a high death rate due to lung cancer in men and now also in women. Alcoholism and drug addiction in Poland account for negative health effects, although drug addiction is less of a problem than in many Western countries. Improper eating habits, cigarette smoking, and alcohol abuse may be a partial compensation for unfulfilled needs in other areas of life, such as decent housing and opportunities to travel.

Looking at the situation more broadly, life patterns can create serious problems. As we in Poland become more influenced by Western civilization, we must address this issue. We must develop patterns for sustainable development and for maintaining our social values.

The next steps in our country's development depend on politicians. But politicians are susceptible to many types of influence. Because of this, there is a need to develop strong centers in which people of many disciplines can study a broad range of issues concerning health, work, and the environment—centers where they can develop a wide perspective on these matters—and centers from which they can influence public policy and can stimulate public action.

These are difficult and challenging times. We face serious economic problems. Our democratic institutions and processes are not fully developed. The health of the population is threatened by a number of factors, including occupational and environmental hazards. But we are committed to protecting workers, the environment, and health, and we welcome your partnership.



Castle Square in Warsaw.

PROSPECTS FOR LNVIRONMENTAL PROTECTION DURING ECONOMIC TRANSFORMATION IN POLAND*

presented by
Andrzej Skowroński
Polish Academy of Sciences
Center for Raw Material and Energy Management
Krakow, Poland

Statistical data and analytical reports show an energy consumption index of national income produced in Central and Eastern European countries that is several times larger than that in OECD countries. This is the result of their historical delay in development and, above all, the result of wrong political and economic doctrines applied in these countries during the past several decades. It relates especially to Poland, where about 80 percent of energy comes from solid fuels, mainly coal and lignite ("soft coal").

This structure responds to the situation in Western countries several decades ago. Simultaneously it can be a synthetic measure of the changes that our country must undergo as quickly as possible, in order not to irrevocably lose distance to highly developed countries. Such a structure of national energy is the result of complex political factors, as well as natural conditions and economic factors.

The influence of the existing economic structure—especially the structure of fuel and energy consumption—on the state of environment in Poland and its neighbors is devastating. This remarkably harmful influence affects the economy as well as health, and it limits development. Energy conservation and energy efficiency should constitute the important component of energy balance. Energy efficiency is tightly bound with outlay of energy balance. Higher efficiency means smaller energy demand, creating the chance of diminishing primary energy—hence, either its smaller extraction from national resources (smaller capital expenditure) or from imports (smaller costs of purchase of energy carriers).

As a result, we create a chance for decreased economic performance costs and we diminish pressure on the environment because of smaller energy demands. As a result of interactions of energy efficiency, there are relatively smaller pressures on the environment, relatively less energy demands, and a relatively smaller energy supply. There is a synergetic effect on the economy. There is a positive feedback loop, giving a multiplicative effect in the form of more "saved" energy, natural resources, and raw materials; increasing living standards; and a smaller burden on the environment. This loop of interreactions among economy, energy, and ecology can be presented as follows: energy efficiency—> smaller economic costs, smaller energy demands—>

* Authors of this paper are Andrzej Skrowroński and Stanilaw Szukalski.

smaller energy supply—> less pressure on environment—> smaller costs to the functioning economy.

It is especially important to present these factors in a final, synthetic form, in order to understand fully and profoundly the various interreactions among energy efficiency, environmental protection, economy and energy balance. This can be of profound significance to decision-makers.

We can discern three especially significant aspects: economic transformation, energy sector transformation, and environmental protection technologies. Estimation of the significance of these factors to improvement of environmental quality is an important goal. Application of a dynamic simulation model of the economy will constitute the analytical base. Results from this model will be used by the expert system, analyzing the problem of energy efficiency capabilities and environmental protection in conditions of economic transformation. This dynamic simulation model represents economic phenomena occurring on a macro scale, while the expert system represents analytic thinking of experts on the problem, taking into account heuristics, experience, knowledge, quality factors, and uncertainties. Hence, the interaction of the systems is natural.

Transformation of the Polish economy towards the market system, the increase of connections with world markets, and closer relations with European organizations will lead to profound structural changes. These alterations will be manifest in modification of the employment structure, the structure and assortment of produced goods, and the branch structure of production. The significance of some branches of production will diminish and others will increase. Modification of the production structure as well as of the structure of national income will force alterations in energy supply. This, in turn, will exert pressure on energy conservation, and change the relation between the amount of imported energy and the amount produced in the country.

On the other hand, the scope and pace of economic transformation can depend to a large extent on the range and the scale of energy conservation. During the process of economic transformation, mutual adaptation between the energy sector and the rest of economy will take place. The result of this adjustment will significantly determine the range and the pace of economic transformation in Poland. Obviously, the "game" between the energy sector and the rest of the economy will greatly influence the state of the environment. This is of great significance not only for Poland, but also for its neighbors.

The efficiency of implementation of environmental protection technologies can be analyzed only in terms of pro-ecological structural modifications in the economy, including modifications in the energy sector. Application of the most modern technologies protecting the environment to the old economic structure will result in minimal benefit.

Economic transformation should radically change branch structures of production and the structures of consumption of primary energy production and the production of cement, steel, and other goods, which are of special significance for the environment. The Polish economy is characterized not only by excess energy consumption, but also by unreasonable consumption of raw materials and resources. Such products as steel, cement, energy carriers, and many raw materials constitute the primary output of certain branches of industry and at the same time are the inputs for, or byproducts of, other industrial branches and economic sectors. Decreased production of these raw materials, a result of structural changes related to economic transformation, will revitalize the environment—an "ecologic dividend" resulting from this transformation.

Economic transformation should lead to modification in quality of produced goods because of increased international competition (wider connections with world markets) and internal competition related with enhanced market influence.

The next important economic factor is production quality. There is another loop of interreactions: pace and scope of economic transformation—> competition range—> increase in quality of goods—> decrease in consumption of raw materials in the national economy—> decrease in energy consumption—> revitalization of the environment (more clean air and water)—> improvement of the quality of products and less consumption of raw material and energy carriers.

Improved product quality contributes to improvement of the competitiveness of products in the market, which, in turn, strengthens the process of economy transformation.

In the evaluation of ecologic effects, their balance (a surplus is an ecologic dividend) can be done indirectly by comparing the consumption dynamic of primary energy, steel, cement, and electricity, and the amount of transported goods with the dynamic of gross national product (GNP). The ecologic dividend will appear when the dynamic of consumption of environment-pressing production factors is lower than the dynamic of the GNP. In conditions of a positive process of economic transformation, consumption of the above-mentioned products cannot grow faster than the GNP.

Evaluation of prospects of energy efficiency and environmental protection in Poland will, of course, depend on the chances of a favorable process of economic transformation. The estimation of these chances could be done with the help of the above-mentioned computer simulation and use of an expert system. Before this, however, the evaluation of previous major tendencies in the most important indices of economic growth and environmental pollution is needed. The analysis of former tendencies allows formulation of a diagnosis of the state of the national economy, considering the state of the energy sector and the environment. This diagnosis must comprise observed trends of national economic development and their effects on this environment. This is necessary as the starting point of simulation experiments to define directions of further economic transformation and possible threats to it. Simulation comprises quantitative analysis, which should be complemented by analysis of qualitative factors, difficult to verify in a numerical simulation experiment. Such analysis, including interrelations of social and political factors, could be done with the use of an expert system.

Among others, the following factors can be included: (a) public opinion on the subject of some important problems, such as location of nuclear power plants; (b) public preferences, such as for economic growth at any cost; (c) the internal political situation and its influence on the economy; (d) economic cooperation abroad; (e) foreign investments in a country; (f) economic politics in a country; (g) external political pressure contributing (or not contributing) to environmental protection; (h) short-term and long-term chances for social and economic structures to the system of other countries and European organizations (such as the European Community); (i) unexpected national and foreign events influencing the economic and ecologic situation (such as wars, natural calamities, and epidemics); (j) the level of development (customs, mentality, education, state of law, law observance, and ecologic consciousness); and (k) pressure from surrounding countries (such as highly developed countries exporting pollution).

The analysis of the problem considered in this project with the help of an expert system must also take into account such elements as certain government energy politics connected with environmental protection (such as pollution standards, systems of payments and fines, and so-called resale of emission rights of specified amounts of pollution).

Energy politics may express itself in different ways. It may be directed to the use of some fuels and not others, and may be connected with costs of the energy system to function. It may be related to investments, level and kind of pollution, and type of industrial technologies used for production. Energy politics can affect the direction of economic transformation in the long run. To achieve energy efficiency and environmental protection with the required social and economic effects, investment is necessary, creating industry working for energy efficiency and for environmental protection at the same time. Economic transformation brings with it the opportunity for developing industrial branches such as "high tech" industry. These branches form the so-called technical basis of energy efficiency for environmental protection—without which there is no possibility of positive economic transformation in an effective and pro-ecologic direction.

Finally, capabilities of energy efficiency and environmental protection will depend on the functioning of many quantitative and qualitative factors, of interrelations, acting with different delays and forming a dynamic system. Generally speaking, the balance between the necessity of economic development and requirements of environmental protection should be preserved. The energy sector plays an important role here, as energy production is simultaneously an economic growth agent, a consumption constituent, and an environmental "poisoner." Achieving this balance constitutes the main challenge.

WORKERS' HEALTH CARE IN POLAND: FROM A CENTRALIZED TO A DECENTRALIZED SYSTEM*

presented by
Janusz Indulski
Nofer Institute of Occupational Medicine
Łódź, Poland

Poland is undergoing a thorough transformation in its political and economic systems. Described as "the shift toward a united Europe," this trend has been reflected in steps taken by the Government to associate with the European Community (EC) and, eventually, after meeting all procedural requirements, to become a full-fledged member of the EC. In order to achieve this objective, many preparations must be made, including those that deal with social rights in general, including occupational safety and health. Poland's association with, and eventual integration into, the EC structure requires adjustment of Polish laws and practices to those of other EC member countries. Ratification and observance of International Labor Organization (ILO) conventions serve as an indication of Poland's ability and commitment to adjust to the prevailing situation in other EC member countries.

ILO conventions constitute a comprehensive package of regulations, many of which were not observed in the former Polish People's Republic, even though they often covered crucial matters. The regulations referred to include: (a) Convention 161 (1985) on occupational health services; (b) Convention 155 (1981) on safety and health of industrial workers and the working environment; and (c) a package of conventions on the protection of health of workers exposed to specific workplace hazards, such as carcinogens, noise and vibration, building industry hazards, materials handling hazards, and hazards associated with working the night shift. (In addition, after 1992, the Social Rights Charter of the European Council will be effective.)

Although Poland has not yet signed these conventions, during the 1990 meeting of the ILO, our country declared its intention to ratify and implement these conventions. However, ratification itself is not essential, but the incorporation of these conventions into the legal system of our country is essential. The primary objective of the needed transformations is to ensure a system of the workers' health care with standards compatible with those of developed countries.

The assumed principle of the modified system of occupational health care is multiple responsibility for activities that involve specific tasks. The desired effects can be achieved only if all tasks are performed correctly by all partners to achieve a situation in which, according to a World Health Organization (WHO) expert group, "the work-related degradation of the employee's health should not proceed faster than that caused by the normal aging process of the human organism."

* Authors of this paper are Lech Dawydzik, Janusz Indulski, and Jerzy Kopias.

Coordinated, compatible activities of the following five groups involved in the transformation process are necessary to ensure effective health protection for workers: employers, employees, and representatives of the health care sector (at present, industrial health care) and two control institutions, the State Sanitary Inspectorate and State Labor Inspectorate.

The system of the worker health care is, therefore, designed to constitute an intersectoral network of associations, activities, and responsibilities, consistent with WHO and ILO documents. The essential thing is not the concept of the distribution of the tasks, but finding mechanisms to enable or enforce appropriate cooperation between the partners. For efficiency of the system, all involved parties should ensure safe and healthful conditions of work. No mechanisms now exist to promote such cooperation. In some cases, opposite motivations occur; for example, extra payments that are made to workers employed under hazardous conditions cause them to object to actions taken to improve these conditions. Circumstances arise under which activities of the control institutions, such as the State Sanitary Inspectorate and the State Labor Inspectorate, bring temporary effects rather than sustained, long-term improvements. The needed transformations can be effective only if a complete set of the control mechanisms is implemented.

Research Facilities at Nofer Institute of Occupational Medicine in Łodz

Economic changes, especially those related to ownership, combined with the poor economic condition of most large industrial plants, have made existing principles for the organization of employee health care no longer feasible. These principles, employed until now, have included: (a) establishing workers' health care units in large state-owned industrial plants of the processing, house-building, and transportation industries, with the costs of running these units being included in the overall costs of plant operations; and (b) ensuring within industrial health units consultation on occupational health to workers in smaller plants, with such units intended to be established at accessible specialist health care complexes. However, these plans have never been fully implemented. Occupational health care services were made available only to three-fourths of workers at industries intended to be provided with industrial health care units. In addition, over half of the specialist health care complexes failed to establish occupational health care units, thus depriving employees of small plants professional-level preventive industrial health care services.

Our current situation requires starting diversified actions including: (a) providing model solutions to worker health care, based on functional solutions; (b) undertaking new activities resulting from the changed nature of occupational exposures; and (c) preserving human and material resources of occupational health care as a part of the general resources of the national health service.

Occupational health care (OHC) has become a subsystem of the health sector—one that was among the first to undergo modification. In May 1991, the Labor Code was amended so that it would cover the new principle of the employer's responsibility for the organization and financing of health care for workers. The amendment includes: (a) an obligation for the employers to have the results of the examinations of harmful agents in the workplace and to keep workers informed about workplace hazards and their potential effects; (b) a principle of employing only those workers who present valid work capability certificates for a given workplace, issued after a periodic medical check-up; and (c) a principle of employers' liability for covering the costs of determinations of harmful agents in the working environment as well as the costs of periodic examinations of workers.

Recently, some proposals have been developed for actions to facilitate implementation of these plans, but the legislative procedure for their enactment is far from being complete.

Another important legislative measure regarding modification of the occupational health care system was the annulment in November 1991 of the Cabinet's resolution making management responsible for the costs of running the OHC unit—but not the costs of paying its staff.

Although both regulations are related, annulment of the Cabinet's resolution seems to be premature because there are not adequate budgetary resources of taking over, by way of purchase, the OHC units from the enterprises. This has considerably endangered maintenance of OHC units.

The present condition of the OHC units is complex, and it varies according to status and location, but a few trends are present. Since the in-plant and inter-plant outpatient clinics were established on the premises of national enterprises, which are now in very poor economic condition, most of them are planned to be closed down. This refers, to a lesser extent, to large enterprises, where the costs of operating OHC units constitute only a fraction of their expenditures and workers strongly oppose the closing of the OHC units. But small factories often offer the facilities of former OHC units for sale. Because of financial constraints, the health sector is not likely to become the owner of any of these.

In contrast, OHC at private enterprises is in fairly good financial condition. Some employers plan to take over the costs of operating OHC units, including personal payment, and they are willing to become the founding bodies, made possible by a new law on health care units in Poland. However, some issues related to the procedure have not as yet been regulated, such as making a contract on use of public resources to finance health care activities or the issue of authorizing the health care unit to issue certificates of work capability. It is hoped that these problems will be solved and any obstacles eliminated as the new act on the health care units will be put into effect.

Some resources could be saved for use by the health service. For example, some OHC practitioners try to undertake preventive activities at their own cost, although the lack of facilities is a considerable impediment. Sometimes they make attempts at leasing premises to establish a clinic, but current regulations severely limit this activity. Some danger lies in undertaking occupational health practices by physicians with no professional background in this field. Therefore, regulations have just been developed.

Modification and reshaping of OHC varies among units at the district and regional level. On the one hand, there is a tendency to integrate all activities related to occupational health in one institution. Thus, complex OHC services could be provided at one location, including consulting and diagnostic activities as well as professional supervision and training. On the other hand, opponents say that the OHC units must be closed. This view derives mainly from incompetence of local health care organizers. Further work on modifying OHC should make every possible effort to preserve already existing human and material resources.

Modification of OHC and its transformation into a system oriented towards functionality assumes structural diversity of the new system. Components of OHC could be both public health centers and other institutions (companies, cooperatives, and private enterprises) that would not use the national budget to support their activities. There should be multiple sources and possibilities of financing the activities of OHC. However, in practice, it would be impossible to precisely classify OHC units according to the source of financing as some of the non-public institutions will have access to State budgetary resources.

One could even imagine a situation in which the administrator of the resources in question would arrange a kind of auction for the delivery of certain services. Possibly the most effective offer for the use of resources could be presented by an OHC unit outside the national system.

The structural diversity of the system will make it difficult to determine the price for and cost of OHC services. From now on, this will be decided at the level of a particular OHC unit, not at the central level as before. The system, based on a variety of institutions in a free-market economy, would have different prices for services. As the workers' demand for OHC services is responded to by laws presently introduced, a comprehensive and complex health services market may soon be developed.

Important activities for OHC modification that are carried out by other sectors include: (a) amendment of Section X of the Labor Code, preceded by some executory provisions of the Ministry of Health and Welfare; (b) introduction of the principle that the premium should be set according to indices of work safety and hygiene, an activity carried out by the Central Institute of Labor Protection, as ordered by Minister of Labor and Social Policy; and (c) change of the principles of work capability, an activity carried out by the Social Insurance Institution.

DISCUSSION

Dr. Judith Perrolle: Will privatization affect the government-operated occupational health services?

Professor Indulski: Until now, the occupational health service in Poland has had 10,000 physicians, over 7,000 of whom were fully specialized in occupational medicine. However, most of them are more interested in curative medicine than preventive. It is a difficult situation. In addition, private companies generally do not support having a special program for occupational health and safety.

Dr. Mykola Prodanchuk: Would a health insurance program work in Poland?

Professor Indulski: Our people emotionally believe that if we introduce an insurance system we will be 20 times better off. That is not true. My personal opinion is that we need to calculate reasonably the economics of health care. Poland is both very rich and very poor. We have too many doctors. The United Kingdom (60,000,000 population) has 56,000 physicians. Poland (38,000,000) has 100,000 physicians, and many people say we need more. If we want change, should half of the physicians go unemployed? It is impossible. The number of medical students is rapidly declining. An insurance system is needed, but we need a mix of insurance. Several years ago, our country was rich and our people poor; now our country is also poor. We cannot introduce an insurance system with our people's pockets empty. Possibly a mixed situation can work, with half the money paid by an insurance system and half by the national budget, at least for several years.

A SHORT INTRODUCTION TO HEALTH AND SAFETY AT WORK IN POLAND

Tadeusz Sulkowski
National Labor Inspectorate
Warsaw, Poland

The picture that we find is fairly alarming. There are 16 million people employed in the national economy, 7.2 million in the State sector and in State administration, and nearly 6 million in industry. Over 15 percent of those employed in industry are exposed to one or more hazardous situations. Noise accounts for over half of these exposures; next is industrial dust, followed by exposure to toxic substances. Annually, 8,000 to 11,000 cases of occupational diseases have been recorded in recent years. The most frequent are occupational deafness and pneumoconioses (65 percent) and infectious and invasive diseases (21 percent). More than half of all occupational diseases occur in the machine-building, mining, and metallurgical industries, which use outdated technologies and machinery and do not maintain health and safety standards.

The level of occupational safety is illustrated by the following statistics: there were 116,000 reported injuries at work in 1991, of which 781 were fatal and nearly 5,000 serious (that is, resulting in more than 29 days of sick leave). Occupational injuries occur most frequently in agriculture, industry, and construction, but agriculture, in our opinion, leads also in the number of serious injuries. The most common cause of work injuries (about 60 percent) is negligence of regulations. About 20 percent are due to poor work organization, poor supervision, lack of training, or inadequate regulation or equipment at the workplace. Poor technical conditions and insufficient or ineffective safety equipment account for nearly 10 percent of work injuries.

There are nearly 2.1 million private farms employing about 4 million people. The work conditions on private farms are known to be generally bad, yet they have not been surveyed in any form. Indirect information about the level of occupational safety on private farms can be extracted from records of insurance companies. The number of injuries (including fatal injuries) on private farms are more than half of all injuries in the rest of the national economy, including those in industry. A rather alarming conclusion is that agriculture is the most backward and least safe sector in the national economy.

Let us now look at future prospects and new solutions ahead of us. Poland's standard of living and the threat of unemployment provide little encouragement for the workers to seek improvement in their working conditions. The trade unions raise occupational health and safety issues, but find only moderate response among the masses. Under these circumstances, initiatives to improve this situation rest increasingly with the State. The National Labor Inspectorate (NLI), which I direct, deals with these efforts in a comprehensive manner. The NLI is established to enforce and control the execution of labor laws, including health and safety regulations. The NLI reports directly to the Polish parliament. It has attracted a large group of professionals: about 900 inspectors and about 350 staff officers. Besides enforcement, the basic tasks of the NLI also include initiating changes in legislation and regulations concerning safety and work environment.

The NLI works in cooperation with the ministers of labor, health, and environmental protection. Another very important task of the NLI is to advise and provide information to employers, especially new ones, covering their duties and responsibilities as well as recommended methods to comply with official standards. We also promote and disseminate knowledge on occupational safety and health, especially for trade unions. Our financial resources are very limited. We collaborate with International Labor Organization (ILO) in a program that trains trainers for trade unions in occupational health and safety. Despite all the neglect of occupational health and safety and the degradation of the working environment, there is great enthusiasm among people involved in these matters, especially among labor inspectors. In order to facilitate urgent changes to improve the overall situation, we have collaborated with the Ministry of Labor to prepare a law on occupational safety, which is a part of an overall code of labor laws in Poland. It deals with the basics, and will require more specific regulations. An amendment imposes fundamental responsibilities on the employer and sets tests for employees, obliging them to cooperate in safety at work. Until now, a worker has been treated as a passive subject, uninterested in the improvement of health and safety conditions in the workplace. In addition to new solutions that are designed to bring new laws closer to ILO conventions, there has also been introduced, after a German example, a regulation requiring a safety officer in every industrial enterprise employing more than 100 workers.

A very urgent task that we face is adopting regulations that are consistent with other occupational health and safety conventions, laws, and regulations in Europe. We would like the benefit of the experience, expertise, and assistance of our Western partners in our endeavor to implement our objectives.

We are fully aware that occupational health and safety depend not only on legislation and modern technologies but also on human awareness of these problems. We still have much to do to make people realize this.

We are open to cooperation with other countries of our region in an effort to improve the state of occupational health and safety.

DISCUSSION

Dr. Yuri Kundiev: What kind of injuries occur in agriculture?

Dr. Sulkowski: Most injuries in private agriculture are caused by primitive machines, many of them made by farmers and used without any safety protection, so they are particularly dangerous. It is a very serious problem in our agriculture, from shoes to tractors. Pesticide poisoning is also frequent.

Dr. Kundiev: Do you have special regulations for labor protection of women?

Dr. Sulkowski: We have regulations concerning women. They are not permitted to participate in particular kinds of jobs or kinds of work.

Dr. Halina Brown: What about occupational health and safety in small workplaces, where employees may not be aware of workplace hazards and employees are often desperate to keep their jobs, even if their jobs are hazardous?

Dr. Sulkowski: Health and safety in small workplaces concerns the activity of three institutions: (1) the NLI, although our inspectors are officers whose visits at the workplace are often quite limited; (2) trade unions, where they exist, which enable workers to present problems to our inspectors in a better way; and (3) safety representatives of the firms, whose role had been well established—but in the past several years has been greatly decreased.

Mr. Lucjan Muchowski: Our situation is complex and challenging. Speaking as a labor economist, I note that this transition period is characterized by two indicators: nearly three-digit inflation and two-digit unemployment, both of which are unacceptable for the long term. In such a situation, model approaches have little relevance; we have to adopt emergency policies and emergency programs. For trade unions, the priority now is survival. Most enterprises are state-owned. Unemployment is very drastic; about 17 percent of workers are unemployed in some cities. Factories do not know how to privatize.

Within such a framework, the NLI actively supports the idea of tripartite cooperation in Poland. Last year, our training center invited trade unionists, both from Solidarity and from the All-Polish Alliance of Trade Unions. Today, we train trainers. We are under severe financial strains, but are in a better position than trade unions or the Confederation of Polish Employers. They are just stabilizing their structures, and they have difficulties as well because many businesses, especially in the industrial sector, have nearly collapsed. In the commercial and service sectors, it is better.

Trade unions are now reluctant to be involved with conferences like this one. Like your safety representatives in the United States, we have civic labor inspectors; but in this situation when we are fighting for survival, there are also problems of occupational hazards — and they neglect these. And there is no money for training such specialists--it is not a priority. Joint efforts with the International Labor Organization, European partners, and American organizations, such as OSHA and the EPA, have been helpful. There is a well-organized center for retraining--preparing skilled construction workers—which is done by the Solidarity Foundation in Warsaw. There are also labor offices trying to retrain and rechannel the work force. This retraining is a priority. We welcome assistance from the experts and volunteers from Western countries. With involvement of foreign experts, the research project for participatory management, including safety, has been established at the University of Łodz.

NEW STRATEGIES IN IMPROVING WORKING CONDITIONS IN POLAND*

presented by
Maria Konarska
Central Institute for Labor Protection
Warsaw, Poland

Many accidents in Poland result from poor safety conditions and insufficient implementation of ergonomic principles at work. The accident rate in Poland in 1991 was 8.4 per 1,000 workers. Between 1990 and 1991, the number of reported occupational disease cases increased from 9,226 to 11,988. Absenteeism due to diseases related to work accounts for 26 percent of all sickness absenteeism.

Only half of Polish workers are still working when they reach retirement age. Excess mortality of men, and recently also women, in the so-called "production age" (35 to 45 years) is alarming. This alarming situation is a result of obsolete technology and equipment; poor organization of work processes; and inadequate, insufficient, and ineffective systems of legislation and management.

Poland is now in a very crucial period because the national economic system is changing. The main directions are changes of ownership of enterprises and implementation of free-market economy rules. This means implementation of new systems of responsibility among employees, employers, and government.

The next reason why the changes of legislation are urgently demanded is association of Poland with the European Community (EC) and the perspective of EC membership in the future. Harmonization of Polish regulations on occupational safety with EC directives and standards is required. Thus, all new legislation should be based on International Labor Organization (ILO) conventions and be harmonized with corresponding EC directives and ISO and CEN standards.

New basic regulations allow development of activities in different fields to make implementation of the principles of safety and ergonomics effective. There are different bodies involved in activity in improving conditions in Poland—from Parliament to the Central Institute for Labor Protection, which is mandated to improve strategic systems of safety.

* Authors of this paper are Maria Konarska and Danuta Koradecka.

Activities that appear to be very important from a strategic point of view in this field are:

To harmonize basic Polish regulations on occupational safety with EC directives;

To implement a system of insurance, which is economically motivating to improving working conditions (variable insurance premium system related to the level of risk due to work conditions in a company);

To develop a common educational system of training in safety and ergonomics on different levels for teachers and students, safety engineers, industrial inspectors, employers, employees, and managers; to establish a training center for safety engineering and ergonomics; and to carry out, publish, and promote research in safety and ergonomics;

To establish a system for certification of machines, tools, and technologies according to safety and ergonomics requirements;

To standardize methods for the measurement and assessment of chemical emissions in technological processes and to improve a system of describing work station conditions and registering hazards and accidents; and

To improve the system of organization of the employment services.

Special attention should be paid to health and safety problems in small firms. This is a new problem in Poland, and new solutions are needed in the organization of the help in labor protection services and labor inspections.

Harmonization: The practical execution of this task required development of a new Polish system of labor protection, a long-term task that should be realized in stages, according to definite priorities. In the present situation, due to the relatively high socioeconomic costs being borne by Poland on account of the deficiency of certain legal regulations and in connection with the decision of the EC concerning establishment of the "internal market" from January 1, 1993, it is very important to introduce into Polish legislation requirements of EC directives in the field of health and safety at work on general requirements of safety and health at work, chemical agents in the working environment, physical agents in the working environment, machinery, personal protective equipment, and certification. The main activity is to do comparative analysis of existing Polish regulations and EC directives and standards, and develop amendments to existing Polish regulations or draft new legal acts.

Variable insurance premium system related to the level of risk due to conditions in a company: A theoretical model of a system of variable insurance premiums depending on the risk level due to conditions at work has already been worked out at the Central Institute for Labor Protection. The main task is to determine the index of risk category for a company (K_z) based on total accidents, fatal, serious injury accidents, occupational diseases, and number of workers exposed to hazardous conditions at work. The next step is to compare the K_z to the mean index of risk for similar companies, and to set an increased or decreased insurance premium for the company according to the risk category for that company. This way, the bad working conditions cost more, and improvement is profitable. (See paper by Jan Rzepecki.)

Establishment of a training center for safety engineering and ergonomics: One of the major causes of bad working conditions in Poland is the lack of knowledge of occupational safety and health issues among people directly involved in the work process. People responsible for the level of working conditions in enterprises as well as supervisors often have insufficient knowledge of occupational hazards including their methods for identification, assessment, and elimination. Therefore, there is an urgent need for providing appropriate training, the result of which will be introduction of good work practices, and thus improvement of work conditions. This need is recognized and treated as one of the priority problems by the Ministry of Labor and Social Policy, by the trade unions, the National Labor Inspectorate, and the Confederation of Polish Employers.

In order to solve the problem, it is indispensable to set up training centers in the field of occupational safety, which will organize special courses for different groups of people involved in the process of work and dealing with: designing technological processes; designing and manufacturing machinery and other devices; organizing work stations; and managing teams and production departments at all levels. These groups include safety services personnel, laboratory personnel, labor inspectors, and other persons with technical education who want to deal with occupational safety and ergonomics problems.

The aims of the centers are to: transmit knowledge of workers' psychophysical abilities in the working process; provide knowledge in occupational safety and ergonomics and inspire trainees to use this knowledge in practice; improve skills in designing safe and ergonomic work stations, machinery, and equipment; teach assessment of hazards at the workplace and how to implement changes in this field; and teach how to organize safe and ergonomic work stations. After completing the training, these groups will be able to immediately introduce improvements at the workplace.

System for testing and certification of personal protective equipment and machinery: Initiation of a national system for testing and certification of personal protective equipment and machinery is needed. The Labor Code requires performing evaluation of work safety and ergonomics of all machines and other technical devices before they will be allowed to be produced. The system for product testing and certification is presently functioning within the existing legal-economic conditions in Poland that includes:

> A manufacturers' warranty system for machinery and other technical equipment, which includes a guarantee of proper product characteristics with respect to safety and ergonomics.

A governmental system for assigning product quality, which is under the surveillance of the Polish Committee for Standardization, Measures, and Quality. The Committee grades a number of mainly consumer products (including some products used for manufacturing).

Specialized systems for quality control of products that include: lifting equipment, elevators, and pressure vessels (under the surveillance of the Office of Technical Surveillance); mining equipment (under the surveillance of the Higher Mining Office); and personal protective equipment (under the surveillance of the Central Institute of Labor Protection).

Until now, the above listed systems have not been working in an efficient way, and did not encompass all the products that are essential for assuring safety at work. This resulted mainly from an improper organization of activities, and from a lack of a sufficient number of specialists and testing units needed for the establishment of parameters for many dangerous and harmful agents, in accordance with Polish and international standards.

Because of the sociopolitical changes in Poland, which are leading to the establishment of a free market for internal and imported products, an urgent need appeared for the improvement of the listed systems for testing and certification, so as to achieve a more efficient elimination from the market of products creating a risk to the life and health of workers. In this respect, essential changes in governmental laws regarding the above systems have been already made, and further changes in regulations are being worked out and are predicted to go into effect in the near future. These changes are directed to full adjustment of the Polish system for testing and certification to the system that will be required in EC Member States from 1993, after the establishment of the Common Market rule.

The Central Institute for Labor Protection, taking into account the need for the establishment of a producer-independent system for testing and certification of equipment used for manufacturing and for worker protection, intends, based on the above-mentioned orders, to take steps for acquiring accreditation as a unit for testing and certification with regard to this group of products (equipment for manufacturing and worker protection). The unit will consist of a group of testing laboratories and an office for certifying products and systems for quality assurance. Obtaining of this accreditation and the creation of proper conditions for operation of the unit will ensure significant improvement of working conditions in Polish industry, through the elimination of unsafe products and worker protection equipment from the market and, therefore, from industrial establishments.

The scope of testing and certification realized after obtaining the accreditation will include mainly especially dangerous manufacturing machinery as well as complex equipment for worker personal protection against serious hazards.

A PERSPECTIVE FROM THE MINISTRY OF HEALTH OF POLAND

Zbigniew Halat
Ministry of Health
Warsaw, Poland

We are grateful to have such an expert group of participants at this symposium to inform and advise us.

As we plan for the future, we must realize that there were a number of positive aspects of the previous system that should be maintained. Of course, we need to modernize, but our public health system is basically sound. We have 320 facilities at the county level and 49 at the provincial level. The public health system employs people from many different professions. About 70 percent of them are graduates of universities—people ranging from food technologists to air, water, and soil specialists, from health educators to epidemiologists to sanitarians.

Many areas are not fully covered by the current public health system, and laws alone will not suffice to bring about public health. So there are some things we would like to change. We welcome Western cooperation in our efforts to strengthen our public health system. And we welcome the assistance of international organizations, such as the World Health Organization and the United Nations Development Program.

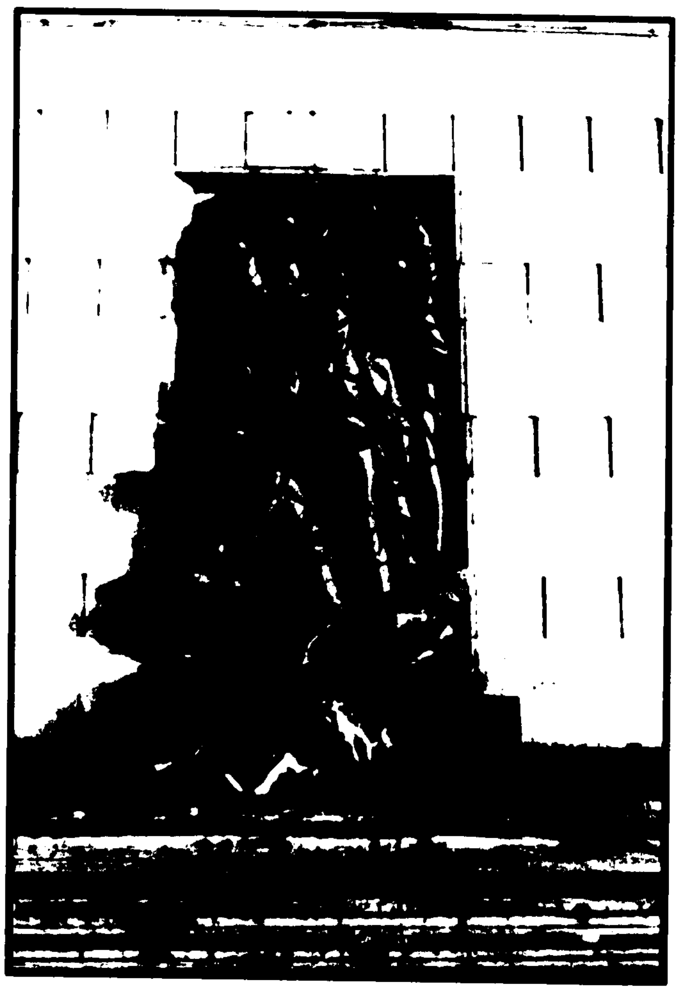
It is to our benefit to exchange opinions with Western scientists and public health specialists. It enables us to adopt a more Western style of thinking. And we welcome Western technical advice.

Not many countries are as advanced in democracy as we are. Poland has always been first in struggles for personal freedom. However, now we have a stormy political landscape. Public health issues become politicized all too easily, and lose their scientific purity. Some people, for their own political purposes and for their own advancement, have become "eco-demagogues." They represent communities that feel that they are being poisoned or otherwise harmed by environmental factors. These people do not realize that lifestyle factors account for more than 90 percent of health status. These "eco-demagogues" do not keep proper hygienic measures, but they accuse other factors of being responsible for their ill health. We need to be strong enough to defend the basics of public health.

We need to strengthen information networks among countries—through journals, bulletins, newsletters, and other means—in order to improve the availability of up-to-date, scientific information.

We need to create a movement for lobbying among the electorate—in order to educate people at the grassroots level on public health issues. It is important for people to get correct information. Today, in Poland, there is too much "noise" (misleading information) on the radio and television and in the newspapers that makes people think in different ways. Everybody wants to say something, and not everything that is said is accurate. For example, many people in Poland are concerned about radio waves, when, in fact, our experts state that radio waves are not a health risk. As another example, lead is a public health problem, but not everybody in a given community is at risk of lead poisoning—although the people may think this is the case.

In public health (including environmental and occupational health), just as in the other medical sciences, a practitioner needs to be able to diagnose, treat, and inform the patient. In public health, the patient is the community. I say to you as fellow public health practitioners: Just be normal, sensible doctors to your patient—your community. A public health practitioner must not be a demagogue or a politician.



Monument to the Heroes of the Ghetto, Warsaw.

DIFFERENTIATION OF INSURANCE PREMIUMS BASED ON THE ASSESSMENT OF WORK CONDITIONS AS AN ECONOMIC STIMULUS FOR THEIR IMPROVEMENT

Jan Rzepecki
Central Institute for Labor Protection
Warsaw, Poland

All employers in Poland pay the same amount of contribution (45 percent of enumeration) to provide for social insurance. The contribution is paid to Zaklad Ubezpieczén Spolecznych (ZUS), the Social Insurance Institution. It is paid along with the contribution of 2 percent of enumeration for the so-called Labor Fund, which is insurance against unemployment. Insurance against accidents at work has never been separated from other types of social insurance.

The now indiscriminate contribution is paid for social insurance regardless of hazards and work conditions. This does not create any motivation in companies to take steps to prevent accidents at work or occupational diseases. Any actions of this kind taken at the company level do not result in tangible benefits, and this is why investments made in order to improve work conditions are not financially profitable yet.

The system of variable premiums in insurance against accidents at work has been in operation in most West European countries for some time now. It is one of the fundamental economic measures that insurance institutions use to influence companies to intensify their efforts aimed at improving working conditions.

Draft copies of legal acts concerning organization and financing of social insurance are now being prepared at the Ministry of Labor and Social Policy in Poland. The drafts introduce insurance against accidents at work as a separate kind of insurance with variable premiums.

A theoretical model of the system of variable premiums depending on the risk level due to working conditions has already been worked out at the Central Institute for Labor Protection. The model contains some elements of the system that used to be in force in Poland before World War II. It also draws on the experience of West European countries, but has been adapted to fit specifically into Polish conditions.

The risk criteria adopted in the model differ substantially from the criteria commonly used in West European countries, where the premiums are determined primarily by the total volume of payments made from the insurance fund to pay damages and other accident-related benefits in particular branches and companies. Adopting cost criteria, especially in the first stage of the system's implementation, seems highly unrealistic because, so far, the Social Insurance Institution has collected virtually no statistical data on the costs of accidents.

And yet, the new approach to contribution differentiation that is proposed here should build motivation and enhance efforts aimed at improving working conditions and the environment. It should be effective especially in those firms and branches wnere bad working conditions prevail, even though the statistics concerning accidents at work and occupational diseases neither reflect nor confirm the low standards.

This is very common in small establishments and minor industries where occupational diseases and work accidents, especially those resulting in serious injuries or fatalities, occur only once in a few years. If the cost criteria were adopted, all these small firms would regularly qualify for reduced contributions.

Frequency rates (per 1,000 employees) have been adopted to identify risk categories for total accidents at work, fatal and serious-injury accidents, occupational diseases, and employees exposed to hazardous working conditions. These rates have been brought together to make a table presenting the range of values divided into 29 groups or risk categories. The lowest risk is reflected in category 1, the highest in category 29. General risk categories for a company or for a whole branch of industry are calculated with the help of a table of the so-called fragmentary risk categories k1, k2, k3, k4, prepared separately for each rate. A general risk category is then calculated as the arithmetic mean of the fragmentary risk categories.

Buildings in Old Town district in Warsaw.

TABLE 1: RULES FOR INCREASING OR DECREASING INSURANCE PREMIUM IN A COMPANY ACCORDING TO THE RISK CATEGORY FOR THAT COMPANY

$K_z = K_b \pm 1$ mean premium in a branch			
$K_z > K_b + 1$ INCREASING PREMIUM		$K_z < K_b - 1$ DECREASING PREMIUM	
BY:	WHEN:	BY:	WHEN:
5% of the base	$K_z = K_b + 2$	5% of the base	$K_z = K_b - 2$
10% of the base	$K_z = K_b + 3$	10% of the base	$K_z = K_b - 3$
....	....	....	....
25% of the base	$K_z \geq K_b + 6$	25% of the base	$K_z \leq K_b - 6$

The two-stage differentiation of premiums at the company level and at the branch level is a major assumption made while constructing that model. The primary differentiation of contributions occurs when the above-listed rates for specific branches are applied to determine the so-called branch categories of risk. On the one hand, they illustrate the average working conditions in branches; on the other hand, they represent the distribution of occupational risk according to branches at the level of the whole country.

The insurance contribution best affects the motivation in companies to improve working conditions at the secondary stage of contribution differentiation. It occurs when an average contribution for a given branch is determined for a set period of time according to the risk category for that branch. The previously mentioned frequency rates are also used for determining the category of risk in a specific company for that company only.

The rules that enable the differentiation of premiums among various companies (either increasing or decreasing them) are illustrated in Table 1. It shows that when the risk category calculated for a specific company equals the branch risk category or when it is only slightly different (+/- 1 range), then the company should pay the contribution average for that branch. When the risk category for a given company considerably exceeds the average branch category of risk, then the company should contribute an increased amount; if the average is much below the branch risk category, the company should pay a much lower rate.

The increase or decrease of the premium rate will range from 5 percent to 25 percent of the premium base.

TABLE 2: DETERMINING RISK CATEGORY FOR A COMPANY (K_z)									
	FREQUENCY RATES								
	Total Accidents		Fatal and serious injury accidents		Occupational diseases		Workers exposed to hazardous conditions at work		Risk category
Company (mine)	Index	K_1	Index	K_2	Index	K_3	Index	K_4	K_z for company
A	50.0	18	2.0	20	3.0	14	500.0	15	17
B	30.0	8	0.50	6	0.0	1	450.0	14	7
C	40.0	11	0.6	7	1.5	7	500.0	15	10
Branch of Industry									K_b=11

I have determined risk categories for all branches of industry in Poland according to statistical observations of frequency rates performed over many years.

Let us consider now one of these categories for one branch of industry. The risk category for the coal-mining industry is 11. A case example of three coal mines presents clearly the way the calculations are done to differentiate insurance contributions in coal mining. As shown in Table 2, only one of the mines—Mine C—belongs to category 10, and thus should pay the usual contribution for this branch. Mine A has a poor record—there have been many accidents registered, both serious and fatal, as well as many cases of occupational disease; so the company is classified in risk category 17, which means that the contribution will be increased by 25 percent in relation to the contribution base (see Table 1).

One can assume that the contribution according to the risk category for that branch amounts to 8 percent of enumerations, so Mine A should pay the contribution which is 10 percent of enumeration (25 percent more than 8 percent). Mine B, with relatively few accidents and no registered cases of occupational diseases, has a risk category of 7. This category is much lower than category 11 ascribed to coal-mining, so the insurance contribution of Mine B will be decreased by 15 percent of the contribution base—that is, it will only be 6.8 percent of the enumeration.

The actual amount of premiums paid in various branches should be calculated according to the rules applied in the West. To do this, it is necessary to know risk categories, the total sum of enumerations for given branches, and the so-called total expenditure (by the Social Insurance

Institution), which is the amount of money that has to be obtained through variable premiums. The theoretical model of a variable premium system that has been developed at the Central Institute for Labor Protection and briefly presented here should, of course, be first tested at the industrial level before full-scale implementation.

At this point in the project, the main objective of the research and development studies will be the experimental testing of the theoretical model of a system of variable premiums related to the risk level due to working conditions. Prior to the experiment, there will be some work done on the sources of information concerning, among other things, the data on work conditions in a given company in the last three years, including accidents at work, occupational diseases, employees exposed to hazardous conditions, and the rate of employment and wages in relation to total production costs. Some questionnaires will be prepared to perform surveys in financial and labor safety departments in selected companies.

Working out a complete computer system on variable premiums will not only facilitate the implementation at an experimental stage, but also it will be very useful later, when the whole system is in full operation.

The research will be further aimed at:

Working out the method for determining the risk categories that will be most effective in Polish conditions;

Finding the optimal maximum for increasing and decreasing contributions related to the branch average that would stimulate employers to take actions directed towards eliminating occupational hazards;

Obtaining estimates that would illustrate the way differentiated contributions influence economic factors in a given company; and

Applying simulation methods to predict the revenues from differentiated contribution in relation to the total expenditure in the Social Insurance Institution.

AIR POLLUTION MONITORING AS AN EXAMPLE OF POLISH-AMERICAN COOPERATION*

Presented by:
Dariusz Ulatowski
Regional Inspectorate of Environmental Protection
Krakow, Poland

An automatic, continuous system for measuring air pollution has been operating in Krakow since August 1991. Stations measuring these pollutants create an air pollution monitoring network. This is a gift from the United States to the residents of Krakow.

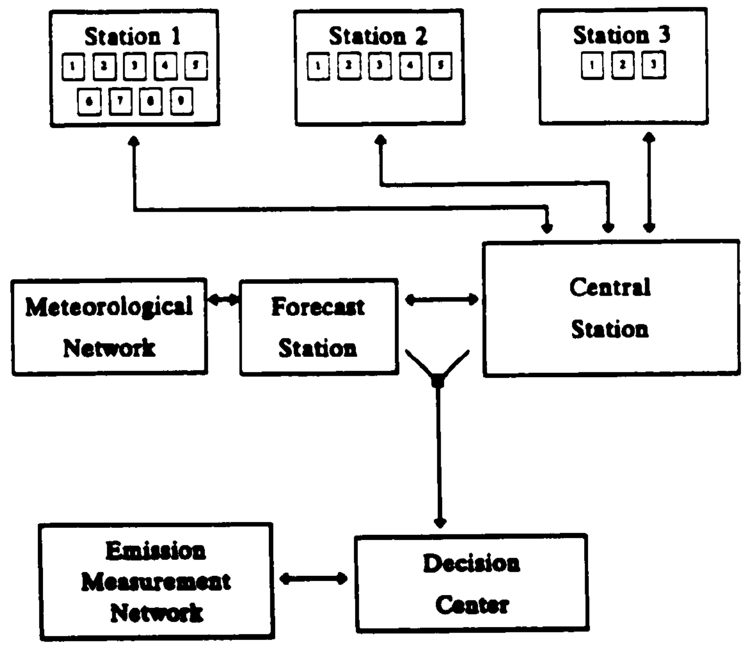
In accordance with conceptions worked out during the last few years, it is expected that air pollution monitoring in the cities and urban-industrial agglomerations will be conducted in two types of networks: in the general supervision network of air quality, which is the prevailing measuring system in urban areas and regions (results of studies will serve long-term atmosphere protection programs and estimate their effects); and in alarm networks (based on automatic measurements with direct transmission of results to the center of the system), which are created only in cities of particular hazard. The main task of these systems is detection and forecasting of high-level concentrations in order to undertake immediate activities toward decreasing the hazard to residents. The network proposed for Krakow is of the alarm network type. The main tasks of Krakow's air pollution monitoring system are: continuous automatic air pollution measurement; providing information about magnitude (quantity) and distribution of pollutants in Krakow; and working out and realizing the administrative and technical counteracting activities connected with states of extreme air pollution occurrence.

Applied monitoring is a dynamic type of monitoring that is able to affect forecasted high concentrations of pollutants. To achieve significant abatement of high levels of air pollution during a short period of time, the following requirements need to be met: (a) obtaining reliable information about the current state of atmosphere pollution; (b) in case of substantial hazards resulting from atmosphere pollution occurrence, giving an alarm; (c) reliably forecasting pollutants for 24 and 48 hours, based on knowledge of the magnitude (quantity) and distribution of pollutants and meteorological forecasts; and (d) making administrative and technical decisions that, in a case of extreme states of occurrence, will reduce emission significantly.

These goals demand the creation of a technical base (measuring system) characterized by (a) existing continuous measuring of pollution possibilities (available only in application of automatic air pollution monitors); (b) taking into account meteorological parameters affecting air pollution magnitude (quantity); and (c) fast and continuous data transmission from the measuring

* Authors of this paper are Krysztof Bolek, Andrzej Heryan, Roman Beres, Leszek Turzanski, and Dariusz Ulatowski.

Figure 1: Structure of the monitoring network



station to the central station—achieved through application of a data transmission computer system using a telephone network.

Figure 1 shows the structural scheme of the monitoring network. The basic constituents of this network are measuring stations, a central station, and a decision center. Furthermore, the following constituents enter into the composition of the overall network: a meteorological measurements network, a forecasting station for distribution of pollutants, and a network for continuous emission measurements.

Emission stations are measuring, in a continuous way, air pollutants and meteorological parameters (direction and velocity of the wind and temperature of the ambient air). These data are transmitted to the central station. Data from the external meteorological network indirectly (through the forecasting station) come into the central station. The forecasting station, based on obtaining meteorological data and values of air pollutants, forecasts the distribution of air pollutants for the next 24 hours. Forecasts and current data on pollutant concentrations are transmitted to the decision center, where decisions connected with the estimation of hazard degree and the manner of counteracting activities to these hazards are made.

The system that has been working since September 1991 is completely achieving the first goal—continuous, automatic air pollution measurements, with the aim of working out the rules of effective counteracting measuring for extreme states of air pollution. (Some legislative changes have been proposed and submitted for approval to the Ministry of Environmental Protection, Natural Resources and Forestry.) At present, the following problems exist: forecast of magnitude and distribution of air pollutants testing, and thresholds of alarm determination. Figure 2 shows a pictorial scheme of the network.

Three blocks can be distinguished in a designed air pollution monitoring network: an emission block, an information-decision block, and a block of emission management, or control. Other units cooperate with the network, such as neighboring networks, chemical laboratories conducting special chemical analyses, and the mass media providing information about the state of air quality and any alarms.

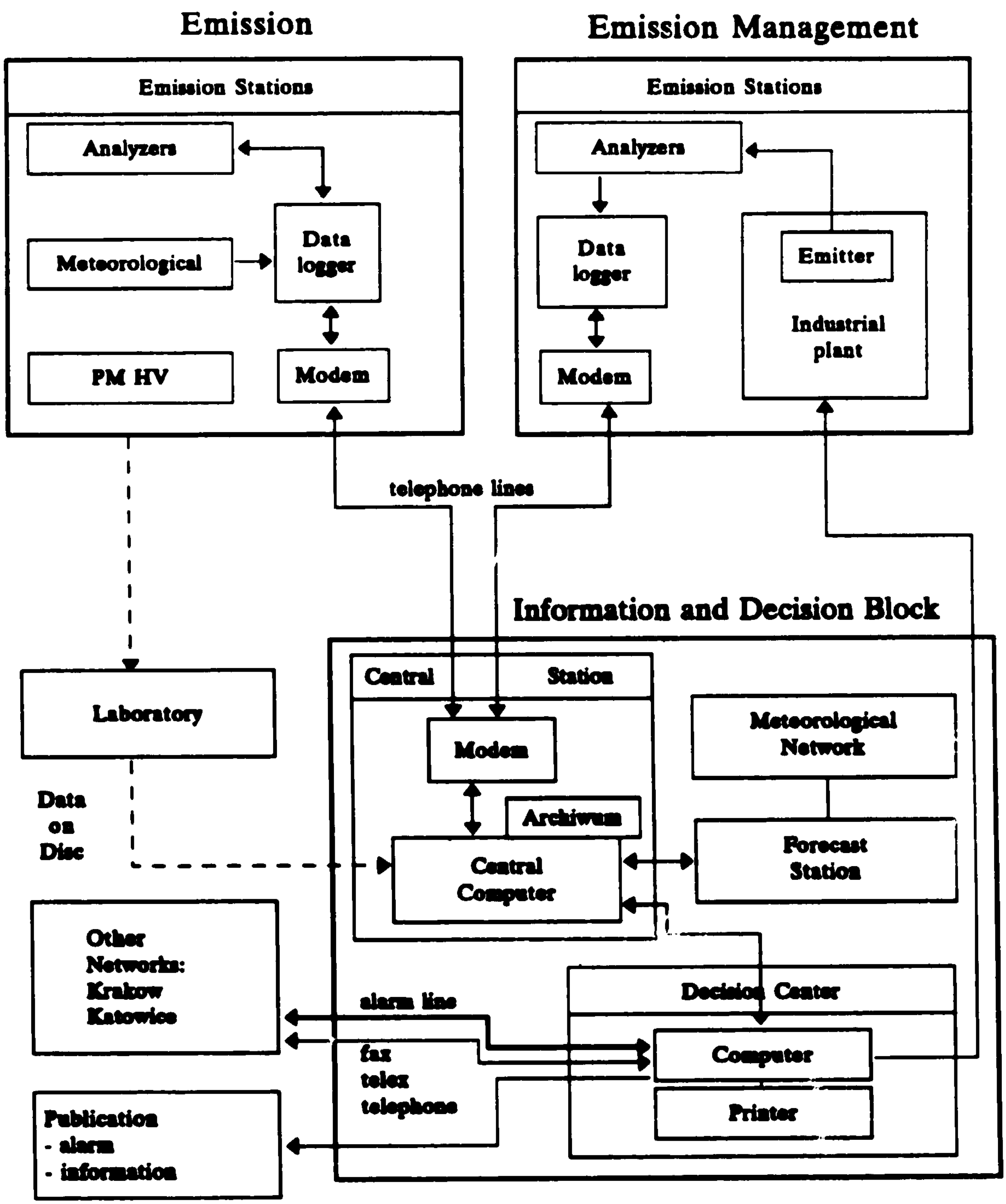
The emission block consists of analyzers measuring in a continuous way the concentration of pollutants and meteorological parameters. These data are transmitted to a data logger, where averaging in 30-minute time intervals is done; then the data are stored. There is a modem at the emission measuring stations for transmitting data to the central station by telephone line. The block of emission control consists of an emission-measuring network installed on point emitters characterized by high values of pollutant emissions. This network enables emission control and observations of the relationship among emissions.

The information-decision block has as its main part a central station equipped with a central computer with peripheral equipment (external device). Current information about the state of pollution comes into the central computer, as well as forecasts of the magnitude and distribution of pollutants obtained, based on knowledge of current pollutant concentrations, and current and forecasted meteorological situations. Data are entered into the central computer. Data relating to meteorological conditions and forecasts come in from the forecasting station. The central computer is connected to a computer situated in the decision station. Packages of information are transmitted from the central station to the central computer on demand. Also, in the case of a smog situation occurrence or its forecasts, the central computer transmits this information immediately to the decision center.

The implementation of air pollution monitoring in Krakow is an example of Polish-American cooperation; the roots of this monitoring project go back to the fall of 1989, when the Vice-President of the United States promised, in Krakow, financial assistance for environmental protection. In the spring of 1990, this assistance took the form of $1 million for the monitoring network. The network came into being in May 1990. The workers of the Center for Research and Environment Inspection, the Bureau of Province, the Sanitary-Epidemiological Station, and the Institute of Environment Protection participated.

At present, the network is operated by a Polish team in cooperation with a team from the United States Environmental Protection Agency. The next planned stage is a visit of the Polish workers who are operating the network to the United States. The goal of this visit is qualifications improvement in the range of analyzer service repairs and familiarization with the activity of similar networks in the United States. Criteria for alarm states include current state of air pollution, current meteorological situation, air pollution forecast, and meteorological forecast. Any alarm will be addressed to the inhabitants of Krakow, the environment protection service, and industrial plants considering environmental protection.

Figure 2: Pictorial scheme of the monitoring network



PART ONE: POLICIES AND PROGRAMS

SECTION TWO: OTHER COUNTRIES IN EUROPE

Top row: Frank LaFerla, Tomáš Trnovec, Jaroslav Volf, and György Ungváry.
Bottom row: Mykola Prodanchuk, Davidas Sčhupakas, Limas Kupcinskas, and Martin Silberschmidt.
Not pictured: Metka Macarol-Hiti, Daniela Pelclová, and Zenonas Stanevičus.

THE FUTURE OF OCCUPATIONAL HEALTH IN EUROPE

Frank LaFerla
Regional Office for Europe
World Health Organization
Copenhagen, Denmark

A large variety of issues are shaping the future of work and health. Politically, Europe is no longer what it was a few years ago. The geographical Europe of the World Health Organization (WHO) has broadened to include a number of new member states. We were 32 a few months ago; we are now 42 and this is expected to increase still further. And this brings new priorities to the general program of our work. In addition, the European region is beset with competing agendas that extend into social, monetary, environmental, organizational, and other policies that are being created. In order to determine future patterns in occupational health within the broader Europe of today, it is, in principle, essential to consider the nature and interaction of these and many other factors.

In attempting some concept of future direction, it is necessary, as a minimum, to first recognize the many newly emerging issues, such as aging populations, increasing number of women at work, increased worker expectations, migrant labor, changing industrial structures, and disability and unemployment. It is also necessary to accept the current levels of incidence, prevalence, or mortality, resulting from occupational injury and disease. In addition, we should take account of the differences in the levels of existing occupational health services throughout the European region. There are, of course, other factors, such as economic ones, the role of the European community, and many others that may affect the nature of work and health in the years to come.

Many questions could be listed and explored. Perhaps it is useful here to remember that, in 1979, Isaac Asimov, referring to working in the 21st century, said, "I hope we will all remember that whenever we look forward into the future, we are looking forward to something about which we have a choice." Predictions of the future are invariably clouded with uncertainties. Nevertheless, understanding the trends and implications, and developing possible future scenarios, probabilities, and interventions can take us a long way in dealing with those uncertainties and, in consequence, improve our decision-making in occupational health. At a time when economic cost is an important element in health care, WHO and other organizations are encouraging the increased use and development of projection tools.

Manpower projections of the major disciplines that are essential for occupational health services have not yet been carried out in most European countries. There are, of course, projections that have been done in general medicine manpower. Rough estimates indicate that over 100 million workers (and I assure you, this is an underestimation) are currently without access to occupational health services within the broader European region. If the future is to realize occupational health equity, a fundamental aim of the "Health for Ail" policy, then the present magnitude of occupational physicians alone would need to be increased considerably from the present number in Europe on newly emerging issues, improvement of competency, and developing strategies for a coordinated approach. And all these are closely related and may require new training strategies. The recognition of the present diversity in education and training of occupational health professionals has, for some time, pointed to the need for developing broad coordinated approaches in this area.

Towards this goal, WHO has called the first consultation, with representatives from different regions of its member states, hosted at the Royal College of Physicians of England, the Faculty of Occupational Medicine, in London. It was unanimously concluded at that consultation that serious consideration should be given to establishing a European academy for occupational health, and we are now preparing to hold a seminar to study the issue and plan the implementation process. Its major objectives, at present, are seen as to bring together occupational health, education, and training bodies throughout Greater Europe and to be guided by existing and newly emerging associations in essential disciplines for occupational practice, such as occupational medicine, occupational hygiene, occupational safety, occupational nursing, and occupational psychology. Also, it will be guided by existing professional occupational medicine or health councils and faculty boards. And, it will also develop international perspectives and continued learning in occupational health. With free movements, competency issues and new learning needs, a strategy for coordinated approaches to education, training, and continued learning will enhance multidisciplinary teamwork and professional standards, and prepare the new skills and close gaps in present training curriculum. It is clear that while the ultimate goal to reduce occupational disease and injury and promote positive health and well-being is very much the same throughout the broader European region, the provision of occupational health services and political and other support are very different.

The responsibility for occupational health services in Europe lies with different ministries in different countries. And it is necessary for closer cooperation to be developed between the different sectors in view of the changing health and environmental strategies in this field. The remaining years of this decade will continue to change both policy and action in occupational health. There are, however, many issues still needing attention that could be mentioned to further strengthen preventive aspects of occupational health services. Whatever is done, however, in the future, we should not neglect issues for which we already have the technology, the knowledge, or the experience to prevent their occurrence. Hepatitis B infection is one example. Within this decade, we should see emphasis on organizational issues, such as audits, in occupational health, and improved management and information systems. We should see emphasis on support systems, such as the development of methodology for teamwork practice, collaborative cooperation, which will include relevant partners, such as labor unions, industries, and nongovernmental organizations.

We should see changes in education and training, most particularly in co-educative approaches and changes in the methodologies of teaching, and development of centers of excellence in selected areas, such as the management of occupational health services or clinical diagnosis of treatment and even networking. We will see certain specific issues; probably the most important specific issues to consider are unemployment, visibility, psychosocial hazards and work organization, and health policies for women and the elderly. One must remember, however, that different countries have different priorities, and while these are common to all countries, for some, other more urgent issues are having increased priority within the immediate future.

There are obviously other issues, and time does not allow us to go into such detail. But we must recollect that as business enterprise is burdened with increasing responsibility for workers, health, and environment issues, pressure will increase to ensure the awareness of employees and their participation and responsibility in maintaining a healthy environment. The communication gap between research outcome and those who need to learn from the results of their work must necessarily be bridged. A coordinated approach is undoubtedly needed to take stock of the overall general progress in occupational health, so that we can provide better vision for the future. If current collection and analyses and comparability of information are improved before the year 2000, occupational health professionals will be in a better position to clarify future directions into the 21st century with much greater accuracy than is being achieved today.

The future will, in fact, bring improved coverage and equity. It will bring adaptation of the occupational health services to newly emerging issues reflecting workplace health. We will bring development of systematic data collection and analysis for comparability wherever possible, and, if this cooperation is achieved, it will establish baselines for future evaluation. Hopefully, we are targeting 1999; we may then have a clearer picture of the health of work of people in Europe. Development and increased use of projection methods for better decision-making will strengthen preventive services and integration of health promotion at work, and this will be a very big and major thrust in the remaining years of this decade. It will undoubtedly lead to development and strengthening of occupational health teamwork. There will be collaborative approaches to education and training, including accreditation. There will be the broader experience of the European region of physicians and those who are in occupational health teams. Further research will be conducted into the measurement and the management of stress at work, the concepts of networking, the health of the unemployed, and the full extent of the management aspect of occupational health. Finally, we will also see European Community developments in occupational health and safety that will be a major force affecting national legislation and, in consequence, bring strong growth in workers' health protection strategies.

I conclude by saying that many of the activities I have mentioned are, to some extent, already ongoing. So my outlook is not as bad as I anticipated in the beginning. Others are just in the process of planning. In the longer term, however, we must remember, it is people who are central to all our efforts, people who draw their work activities, the economy, and the future of countries within the bond.

MEETING THE WHO GOAL OF HEALTH FOR ALL BY THE YEAR 2000: IMPLICATIONS FOR ENVIRONMENTAL AND OCCUPATIONAL HEALTH IN SLOVAKIA*

Presented by
Tomáš Trnovec
Institute of Preventive and Clinical Medicine
Bratislava, Slovakia

This program was formally established in 1983. It was a complete failure at that time, and no changes in health status were observed. In December 1990, right after the "Velvet Revolution," the program was re-established and improved. It is now called the National Program of Health Promotion (NPHP). An important foundation of the program is that everyone is responsible for his or her own health. I will report on aspects of it related to occupational and environmental health.

The health status of the population in Slovakia has worsened in recent decades. Among European countries, we have dropped from 10th to the bottom of the list. Cardiovascular disease accounts for much morbidity. There are in Slovakia each year approximately 25,000 premature deaths due to cardiovascular disease. Cancer, diabetes, respiratory disease, and mental health disorders all contribute heavily to morbidity and mortality. Rates of skin cancer and certain gastrointestinal cancers are particularly high. Life expectancy in Slovakia is approximately 67.3 years for men and 73.5 years for women.

There have been successes in disease control and health promotion. Neonatal mortality is 11.6 per 1,000 live births, similar to rates in other industrialized countries. Communicable diseases have been better controlled. Much of this success has been due to an intensive immunization program for young children.

Primary health care includes many different components. Related issues, such as housing and environmental protection, are receiving increasing attention.

It is necessary to increase the public's knowledge about environmental and occupational health hazards, and how they can be reduced and eliminated. Health needs to be incorporated into planning activities in many parts of society. Since resources are very limited, there needs to be a process to prioritize environmental and occupational health problems. In order to optimize use of limited financial resources, ways need to be developed to motivate businesses and citizens' workers groups to care more for their own environmental and working conditions.

---

* The authors of this paper are Margareta Sulcova and Tomáš Trnovec.

An act passed in 1991 guarantees that air, water, and other components of the environment as well as population health will be monitored. Epidemiological studies will target health status of people in regions that are affected by serious environmental conditions.

Major environmental problems include: nuclear power, on which Slovakia relies for 45 percent of its energy needs; the proposed dam on the Danube River; and areas that are devastated due to noxious factors, especially chemicals in air, water, and soil.

In the working environment, we need to create the legislative, financial, and material means to reduce occupational risks and to improve working conditions with positive, health-supportive effects. A fund must be established for this purpose. Multinational corporations and indigenous businesses and industries need to take a more active role in restoring healthful and safe working conditions. A health insurance system must be established that, in part, takes into consideration the level of health protection and health promotion in the workplace.

Social compensations are allocated for working under hazardous conditions; for example, workers in hazardous jobs are given extra financial compensation and vacation time, and can retire five years earlier than other workers. The NPHP deals with changes in this system. Existing sanctions for violating occupational health regulations are insufficient, encouraging their violation by some employers even if they have to pay (low) fines. Occupational health services, occupational health inspection, and education for a safe and healthy workplace are also part of NPHP.

There must be incentives and resources to strengthen preventive activities. Occupational health education programs developed by WHO and ILO must be adapted for professional medical personnel as well as employers and employees. Information on occupational risks, how to reduce them, and how to work and live in a healthier way, need to be better and more effectively disseminated.

THE ROLE OF PUBLIC HEALTH AGENCIES IN IMPROVING ENVIRONMENTAL AND OCCUPATIONAL HEALTH POLICY AND ACTION

Jaroslav Volf
Regional Institute of Hygiene
Ostrava, Czech Republic

The role of institutes and organizations engaged in public health, in the protection and creation of healthy working conditions, and in health care for working people is determined by several factors. One of the most important factors is the national historical development in the respective country that determines the role and position of the agency. In countries where a natural system of environmental care, including the workplace, has been developed, stabilization has occurred over the period that the organizations have been engaged in environmental protection.

In Central Europe in general and in Czechoslovakia in particular, this development was interrupted. The result was that systems created in other countries took over—in socialist countries the system that took over was created in the Soviet Union.

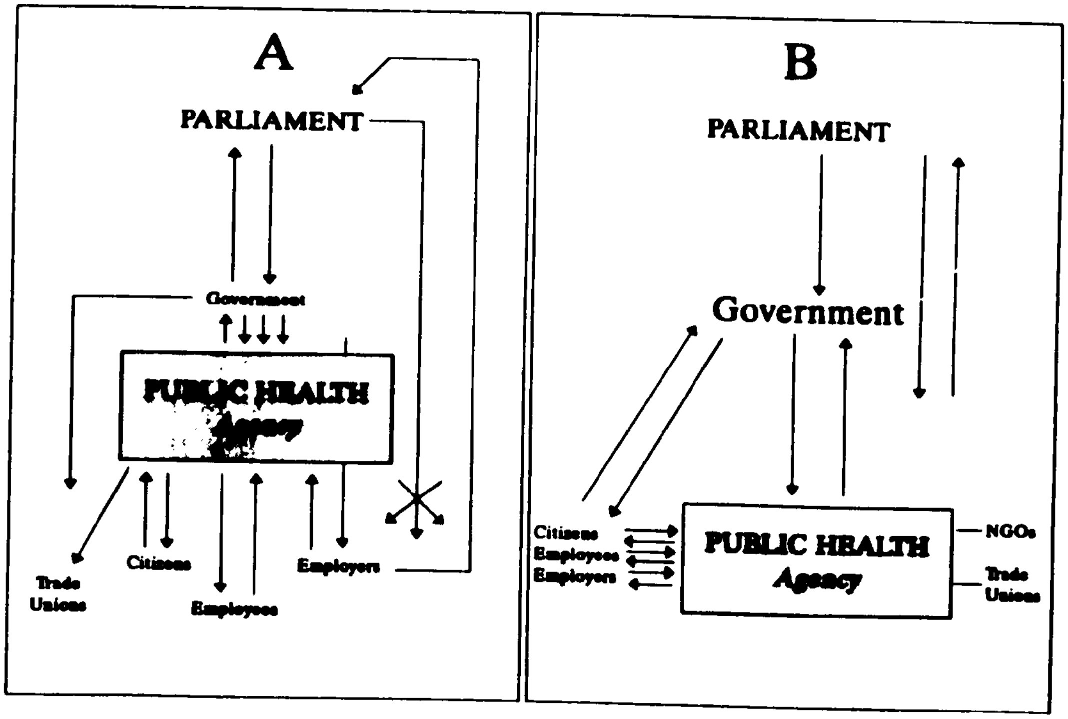
The need and extent of organizations taking care of the living and working environment are determined by the standards and the necessities of the society.

Recently, when I visited Japan, I had the opportunity to study its system of preventive health care. I was able to observe that the network of hygienic institutes was very similar to our system and to the system of the Soviet Union (Model A in Figure 1). On the other hand, the position of environmental protection agencies in the countries of the European Community is more similar to Model B in Figure 1.

Environmental protection agencies operate on two basic levels. The first is an "official" level, with creation and supervision of rules and regulations for the protection of healthful living and working conditions. It is self-evident that any laws approved by parliament can be taken as some agency protecting the living environment of man and animals and ensuring healthful conditions of life. The second level is non-official and includes research, advisory activities, and some kind of moral guarantee of environmental care.

Returning to Figure 1, we can see that agencies and institutions in socialist and post-socialist countries are instruments of governmental politics in this sphere or, if you like, insruments of the politics of the party. The role of these agencies was prescribed by governmental requirements and not by the needs of the society. The society influenced the dominating groups in the field of living and working environment only indirectly. In such cases, the formal role was predominant and that is why the formal planned economy in failing economies was not able to contribute substantially to the quality of the environment. In practice, the specialists of these agencies tried to comply with the basic legislation and to keep at least some reasonable state of working conditions.

Figure 1: Models of Public Health in Japan and the Former Soviet Union (A), and Countries of the European Community (B)



As far as the living environment is concerned, the effort to determine the real status of living conditions was missing, because the description of the living environment and the examination of ecological relations are, more or less, research activities and, as such, not supported by the government. We have lagged in the monitoring of the living environment as we have in the nonformal role of the agency.

On the other hand, in free developing societies, the extent of health services was dictated by the needs of the society. Also, the quality of these services, in both official and non-official levels, was determined, more or less, by the social order. Only a few institutions were commissioned to prepare new laws and regulations, but the new norms were created on the basis of very broad-based research during the past 20 years, in close international cooperation.

What is to be considered as the dominant role in the organization of public health service, of hygiene of the environment, and industrial medicine? I believe that, on an international scale, the first step should be to pass from the bare description of the status of the situation to the evaluation of risk, resulting from the concrete situation. As an example, in many published papers, authors collected concrete data about concentrations of metals in surface waters, solvents in workplaces, or asbestos fibers in materials, air, or water. After transmitting this information to the public, surprise, protests, and even rebellion can be expected, but only seldom is there an understanding of the actual situation and support expressed for further measures.

It is not sufficient to describe the actual situation in concrete numbers. To every number, concentration, or figure found, the measure of risk should be added—that is, the values of risk for living organisms should be determined for every level of hazard. It is simpler for every man and woman, and for the general public, to compare individual risks by individual concentrations.

Let us look at a sample of drinking water. We can find out that it contains more manganese than a standard allows, say twice as much. We can be terrified by this information or we can agree to drink the water. It depends only on our knowledge of the toxicity of manganese and of the doses that can cause observable alterations in living organisms. That is why I suppose that, as far as "data-handling" is concerned, the most important task of public health is to introduce the concept of risk assessment into daily practice, to develop this concept, and to try to describe the main environmental hazards.

A further task that I see today, mainly in post-socialist countries, is to pass from formal dependence on governmental agencies to the less formal, from the "health cop" to the role of adviser. Nevertheless, I do not think that, because of changing that role, the existing systems are to be completely destroyed, deprived of governmental support, or divided. On the contrary, I believe that, for risk assessment, it is necessary to describe all risks as complexly as possible—therefore not separating the living environment from the working environment, or drinking water from air and food. According to my feelings, the main task for the future is to describe and explain all health hazards to the people in specific parts of the world. Then, when people themselves will hold the risk unbearable and immediately threatening, their health and the health of future generations and healthy living conditions for animals, plants, and nature, it will be much easier to implement necessary political and economic measures.

Dr. Jaroslav Volf and Dr. Mykola Prodanchuk discuss a subject of mutual interest.

TRANSLATING SCIENCE INTO OCCUPATIONAL HEALTH POLICY IN HUNGARY: CONTROL OF CHEMICALS, USE OF RISK ASSESSMENT, AND DEVELOPMENT AND IMPLEMENTATION OF WORKPLACE STANDARDS

György Ungváry
National Institute of Occupational Health
Budapest, Hungary

In this paper, I will cover policies concerning activities involving chemicals in a broad sense (chemical safety) in Hungary, development of standards on air contaminants in the workplace, and the importance of risk assessment in creating safe and healthful workplaces in Hungary.

Policy for control of chemical safety and chemical activities is regulated by the relatively up-to-date "twin decrees" (26/1985 MT and 16/1988 EüM). These decrees define toxic substances, and ordain that only qualified materials may be involved in any activity and only with possession of a license. These chemicals can be regarded as materials that were "qualified" by the National Medical Service office in "poison" and "dangerousness" categories by the hygienic toxicological departments of the professional institutes (OMÜI, OKI, OÉTI) according to the above mentioned decrees and their supplements. Based on the document of qualification, the peripheral organs of the Public Health and Medical Officer Service (county and city units) issue the "activity license" for well-defined activities. This regulation is very strict and requires a great toxicological capacity exceeding the capabilities of the country. In this way, implementation of the decrees encounters difficulties, needs much more time than expected, and will not be fulfilled until 1993.

Chemical plant protection is regulated by two decrees made in 1988. These regulations are in accordance with the most strict, most demanding international regulations. An important question of chemical safety is regulated by the 12/1976 law decree on the protection against damages caused by carcinogens and carriers. This decree was formulated in accordance with Hungary's ratification of the 1974 International Labor Conference. Unfortunately, this regulation was not satisfactorily enforced in Hungary.

Many aspects of the control of chemicals, such as control of transportation of hazardous chemicals by train, road, air, and water and control of chemical catastrophes will not be covered in this presentation.

In the protection of workers' health, standards play an important role. In Hungary, the latest (1988) standards prescribe time-weighted average (TWA) values, 30-minute ceiling concentrations, and maximal concentrations. A 1988 standard includes threshold values for chemicals and a 1992 standard deals with threshold values for dusts. The above mentioned standards, presently in effect, contain threshold limit values for 234 chemicals or groups of chemicals and for 10 dusts. The following data are given for each substance: name, empirical formula, category of toxicity, category of dangerousness, time-weighted average, short-term exposure limit, maximal concentration, and characteristics. Poison categories are M-I to M-IV;

these have to declared according to LD_{50} or LC_{50} established by the most dangerous route of administration; these values are based on rat experiments, except when human LD or LC values are known.

Dangerous categories are V-A to V-C; the standard course does not contain threshold limit values for V-D (practically not dangerous) substances. Carcinogens usually have MKk values; the small "k" besides the MK value is the abbreviation for "karcinogen." Letters in the box characteristics are abbreviations of the Hungarian words for effects: "b" means absorption through the skin, "i" irritative, "m" corrosive, "sz" sensitizing effects. In separate supplements, the standard deals with: (a) agents causing asphyxia; (b) carcinogens (it lists and in this way makes public the substances categorized as 1, 2A, and 2B by WHO-IARC); (c) the concept of limit values for hormones and hormone-like substances; (d) the principles of limit values for antibiotics; and (e) the importance of completing standards with hygienic information. It is important to know that the substance is absorbed through the skin because this determines the regulation for personal protection. The standard explains the principles of assignment into poison and dangerousness categories. The earlier standards did not contain poison and dangerousness categories or MK values. Carcinogens were first marked in 1978 in Hungarian standards, with the letter "X". (Earlier Hungarian standards did not contain the supplements mentioned above.)

The following concerns the changes and development of the policy of standards. Determination of limit values was based on animal experiments. Until the 1960s, most of these limit values had been adapted from Soviet values. Later, the ceiling concentration, and recently the maximal concentration (in the case of carcinogens), appeared in the standard. TWA values changed, taking into account the Hungarian hygienic and occupational health experiences and experiences of environmental and biological monitoring. Some values in the standard today are near Western European and American standards. However, most of them are lower than Western European and American standards because most technologies used in Hungary require at least light physical work; in Hungarian workplaces, the minute ventilation volume of workers is not the sedentary 4 liters, but 10-15 liters or more—this means inhalation of 2 to 3 times more air contaminants, which must be taken into account by the standards.

For this reason, we consider the servile adaptation and international harmonization of TWA values unacceptable! Control of limit values is carried out through environmental monitoring in Hungary but the number of measurements is low. In 1991, about 60,000 workplace air samples were analyzed. Individual chemical exposure to 20 chemicals is controlled by biological monitoring. Values of biological exposure indices exceeding the biological limit values have to be reported as increased exposures.

The annual number of registered cases of increased exposure in the past few years has varied between 2000 and 4000. Reported cases of increased exposure are followed by hygienic measures. A national external quality assessment program is run by our institute for the control of some biological indices, and our institute participates in the international external quality assessment programs. This system, the further development of which is justified, is one of the most important guarantees of health in workplaces.

Risk assessment has been introduced only lately for the prevention of health effects due to chemicals in the workplace. Earlier, it was used only for calculation of the limit value of the delayed effect of ionizing radiation. As a starting point or reference value, the 10^{-5} level of an average industrial accident rate was accepted. Calculated this way, the yearly allowable total body burden of ionizing radiation is 50 mSv, in accordance with international standards. Risk assessment for calculation of chemical limit values was first used for carcinogens. The 10 mg/m^3 MK value of vinyl chloride was determined this way.

In conclusion, principles of protection against chemical exposure are modern and guarantee satisfactory safety. Legal regulation needs updating, for which consideration of the guidelines of Commission of the European Communities (CEC) seems reasonable. During this updating, which has already started, workplace carcinogens need to be legally regulated. Benzene, asbestos, and vinyl chloride will be covered by separate regulations as is done in CEC directives. The following will be especially stressed:

> Work involving carcinogens is voluntary.
>
> Those exposed to carcinogens must get all available information on the risk concerning these substances. They must know that they work with carcinogens (providing this information is the duty of the employer), the possible preventive measures, and the expected risk-decreasing effect of these measures.
>
> The number of those exposed to carcinogens must be kept to a minimum. The risk to society must not be increased in order to decrease the risk to the individual; for example, preterm pensions should not be allowed, as this slight decrease in individual risk would increase the risk to the society by increasing the number of people exposed to carcinogens.
>
> Risk assessment and cost-benefit analysis must have decisive roles in the regulation of carcinogens.
>
> To introduce these methods, professionals with appropriate education and policies guaranteeing chemical safety in the workplace are necessary.

In industrialized countries, occupational chemical exposure is responsible for 4 percent of cancer deaths. For the 4.8 million active workers in Hungary, this means a risk of occupational tumors of 2.5 per 10,000 workers per year.

Taking into account, however, that occupational cancers afflict only those exposed to carcinogens at work—an estimated 400,000 workers in Hungary—their risk is 30 per 10,000 per year. This means a 12 times higher risk than the risk of acute accidents in an industry with a high-to-average risk of accidents. Taking into account this adverse effect of chemicals alone, it can be assumed that chemical safety is a major challenge in Hungary. The solution is to apply the most up-to-date regulations, means, and methods for chemical safety both in policy and in practice.

A PROPOSAL FOR A SYSTEM OF HEALTH INSURANCE IN UKRAINE

Mykola Prodanchuk
Ministry of Health
Kiev, Ukraine

The transition from totalitarianism to democracy, and from central control of the economy to a market system, require rebuilding of the public health system, especially in terms of resources and finances. We find very attractive a proposal for a system of medical insurance as a principle for financing health care. The advantage of this system is that it is used in many countries with developed economies. However, the transition from our system of medical services, which is free of charge and has poor management, to a medical insurance system in a free market of health care has specific problems that require not only careful study, but also new approaches. Our experience in Ukraine, our current state system of public health, and the experience of developed countries in health insurance provide a basis for a progressive system of medical insurance, a basis of financing the public health system, and economic tools for preventing hazardous effects of industrial, ecological, and even social practice.

The development of health insurance in Ukraine is occurring in a period when the economy is poisoning the health of the people. By objective criteria, the health status of the people is at a very low level, and the health system is in crisis. There is a lack of drugs and equipment. Because of financial problems, medical specialists cannot perform their duties. At the same time there are some paradoxes. First, health care costs are only 2.5 percent of the gross national product (GNP)—this may be the lowest percentage in the world. Our indices of health in recent years have been very high, even with relatively low expenditures. At first sight, it seems that the system has been very effective, but there are recent trends indicating that the health of the population is getting worse. Our system is not as efficient as it seems. As to the quantity of doctors and other medical specialists per capita, Ukraine is among the best in the world; however, the absolute and relative salaries of doctors in Ukraine are among the lowest in the world.

Let me leave the paradoxes of our destroyed economic and political system. Allow me to propose to you plans for reconstruction of the health system, specifically plans for the health insurance system. The legislative background of the reconstruction is the laws of Ukraine on public health concerning sanitation and epidemiologic well-being, as well as medical insurance. All of these matters are based on the right of people to health—an essential right. We propose new legislation in Ukraine, which at this time is under discussion in the Ukrainian parliament. There are two laws proposed. The draft law on adult public health addresses the main rights of people and the State's duties to guarantee this right. The law about sanitation and epidemiologic well-being regulates the roles of authorities in this sphere. The draft law about medical insurance provides a financial mechanism for both curative and preventive services.

The foundation for health insurance in Ukraine is that better health of the people, which is, in part, due to the health care system, makes good sense economically. Like natural resources, health should be viewed as a renewable resource, the cost of which is equivalent to the money spent on it—money spent to maintain the physical, psychological, and social well-being of the population. In other words, when all costs to society regarding health are considered, the system should pay for itself.

The main principles for determining them require an amount of financing for health and the required demands of resources are as follows. The amount of resources spent on health has to be sufficient for all services to support a state of full physical, psychological, and social well-being for every person in Ukraine. The economic and legislative foundation for determining the exact amounts of these resources includes assessments of health risk for each person, of health and safety conditions at work, and of the status of the natural and social environment. Those responsible for occupational and environment health problems should be taxed accordingly. Health insurance is obligatory for all people. In the main, resources for financing health care will come from insurance fees of enterprises and citizens—their contributions based on the health risk for which they are responsible. The insurance association, according to the draft law, will review the determined values of health risk and will arrange payment for all expenses accordingly. We propose the best ways of spending valuable money—the most effective investments for prevention and treatment.

Municipal Building in Pultusk.

DISCUSSION

Dr. Jerzy Sokal: What are the details of your proposal, for example, on how to charge enterprises for bad working conditions?

Dr. Prodanchuk: We have developed some details for this proposed system. One of the difficult problems is to establish the correct level of risk. It is a methodological challenge, but there are some ways to do this. We propose some level among 1 to 10, 10 to 100; for example: toxic pollutants—class of hazards, class of risk. We can, as hygienists, use this methodology to provide hygienic standards and to establish the level of risk. I believe that workplace conditions account for 15 to 25 percent of health, and environment conditions 10 to 15 percent. We propose to use this mechanism only to provide a preventive project in occupational health and environmental health. It is not necessary to determine this risk to the nearest percent. But now, after the socialist system, we do not have another mechanism to persuade enterprises. In Western countries, there is a different situation because there is much competition among enterprises. We do not have competition yet, we have a monopoly. If we close the enterprises, it is a problem of society, not a problem for the enterprises. But, in Western countries, if some government bureaucrat closes an enterprise, it is a problem for the enterprise. We have a different economic and political situation: we do not have competition among enterprises.

Dr. Judith Perrolle: What will you do with the old companies that are not very profitable?

Dr. Prodanchuk: In this situation, the government pays for the health insurance policy of workers of this company. But we give some credit, in time, to this old company to improve new technologies. However, we cannot provide this system now. Without a system like the one I have proposed, we do not have a mechanism to do so.

Dr. Cezary Korczak: How does this system operate in practice if health insurance institutions give money for prevention or environmental health? Who decides how much to give?

Dr. Prodanchuk: A health insurance company, if it can make a profit, is a commercial company. Its interest is profit. As a possibility for using some of its profits, it covers the scientist or the physician. It should ask two questions: "What is needed now? What is a good investment for the future?"

ENVIRONMENT AND HEALTH IN SLOVENIA*

Presented by
Metka Macarol-Hiti
Ministry of Health and Social Care
Republic of Slovenia Sanitary Inspection
Ljubljana, Slovenia

The Institutes of Public Health in Slovenia, as nongovernmental and nonprofit organizations, support activities of the national disease surveillance system and ecological-toxicological and ecological-epidemiological activities. They also develop operative, technical, technological, and methodological capabilities to levels consistent with modern ecology in Western Europe. As such, they promote cooperation among health and scientific institutions concerning research, development, and educational and coordinative activities, especially concerning the WHO regional strategy for "Health for All by the Year 2000," and directives of the European Community. Their first priority is environmental control to minimize major pollution problems by monitoring and assessing factors influencing human health.

Environmental Health Policy: In Slovenia, there is a large number of regulations for protection of the human environment from pollution. However, the existing system of protection is inefficient and inconsistent. New environmental health policies are being prepared with the intention that they will be effectively implemented.

Our priority task is multisectoral and interdisciplinary: planning for environmental health, health and social services, and development of technology, industry, and agriculture.

Protection of the human living and occupational environment will be achieved by developing ethical norms and a high level of responsibility.

Monitoring and Organization of Environmental Health: Establishing risk assessment in a preventive health perspective demands systematic surveillance as a base on which to build specific environmental data and a health-ecological information system.

A database on the health aspects of food was established many years ago. It permits selective geographical comparison of exposure to specific food contaminants (microbiological and chemical) and the monitoring of trends.

A coherent national database on drinking water, air quality, and hazardous wastes for analyzing and interpreting environmental health hazards is being established. Such a monitoring system

* Authors of this paper are Alenka Kraigher and Metka Macarol-Hiti.

requires close collaboration at the local, regional, and national levels and a strong intersectoral contribution through epidemiological surveillance.

Control of Water Pollution: The hydrological condition in Slovenia concerning the public water supply is very good. The central water supply systems are well established, supplying 94 percent of the total population with drinking water. The problem is that agricultural and industrial development influence drinking water resources to the level that administrative and technical measures need to be undertaken. In order to attain the goal that by the year 2000 pollution of groundwater and other water resources will be reduced, all necessary measures will be taken to comply with public health criteria.

Provision of Safe Food: The negative ecological influences on foodstuffs threaten people's health. This risk is made even greater by modern technologies in production and industrial processing of food, and by changes in lifestyle. Besides microbiological contamination of food, the most frequent causes of food contamination are harmful additives, heavy metals, and pesticides.

Following targets for the year 2000 in Slovenia, comprehensive measures for provision of safe food will be established that will considerably reduce health risk from contaminated food caused by microbiological, chemical, and other agents.

In order to stop foodborne illnesses, many approaches to food safety have been introduced. Among them, education is one of the most important.

A new food safety strategy—longitudinal quality assurance—is going to be implemented. This will include introduction of the new requirements for persons employed in handling food products; hygiene of staff, establishments, and equipment; health control and inspection; and supervision of production, storage, and transport.

A national strategy on nutrition is being established, with intersectoral coordination being done by the Ministry of Health.

Conclusion: Regarding the directives, recommendations, strategies, and other documents, we intended to form a system of useful and good continuous health protection and environmental control. We would like to achieve as soon as possible harmonization of food, drinking water, and consumer products legislation; organization of health control; and cooperation in international projects regarding safety and quality. There is a need to introduce a system to control environmental hazards, with special attention to agrotechnical products, heavy metals, and toxic chemical causes of pollution.

OCCUPATIONAL DISEASES IN THE CZECH REPUBLIC*

Presented by
Daniela Pelclová
Charles University
Prague, The Czech Republic

There are two clinics for occupational diseases in Prague; ours is the older one, started in 1952 by Professor Teissinger, D.Sc., the founder of occupational medicine in Czechoslovakia.

We cannot directly influence occupational safety and health policy, but our work brings us into close contact with results of this policy.

In the Czech Republic, with a population of 10 million people, 8,300 occupational disorders were reported in 1991.

The health care systems of the Czech and Slovak Republics are relatively independent of each other. Each republic has its own Ministry of Health.

In the Czech Republic, the most frequent occupational disorder among the new cases is silicosis (2,900 cases in 1991), especially in miners and other coal workers. Disorders due to vibrations (1,500 cases) are next, followed up by occupational hearing loss (1,400 cases). Occupational skin disorders were diagnosed in 1,300 cases; chronic musculoskeletal injuries due to long lasting, monotonous and excessive work, in 900 cases.

Further occupational diseases were less numerous: 250 occupational infections due to exposure to infected humans or their tissues (half of them represented by viral hepatitis B), and 200 due to zoonoses.

Occupational asthma was diagnosed in 100 cases. Lung cancer occurring in uranium mines due to exposure to radon was diagnosed in 80 cases. Chemical intoxications represented only a small proportion of disorders.

These numbers reflect not only the structure of our industry, health regulations, and the awareness of physicians, but also the legal system of our country, which does not include, for example, injuries of the spine and chronic bronchitis on the list of occupational disorders.

* The co-author of this paper is Jana Vejlupková.

ENVIRONMENT, WORK, AND HEALTH IN LITHUANIA

Presented by
Zenonas Stanevićus and Davidas Sćhupakas
Republican Hygiene Center of Lithuania
Vilnius, Lithuania

Limas Kupcinskas
Kaunas Medical Academy
Kaunas, Lithuania

Lithuania, which covers 65,200 km^2, has 3.7 million residents, 69 percent of whom live in urban areas. The average life span is 72.4 years. In 1990, the birth rate was 15.1 per 1,000, and the crude mortality rate, 10.6 per 1,000. The most frequent causes of death in 1990 were circulatory system diseases (57.9 percent of all deaths); neoplasms (17.7 percent); injuries and poisonings (11.2 percent); respiratory system diseases (4.6 percent); and digestive system diseases (2.2 percent).

One third of Lithuania's population receives its drinking water from wells. In the rural areas, where wells are main source of drinking water, 40 to 55 percent of water samples do not meet standards of microbiological and chemical safety because of contaminants.

Food items have much microbiological contamination. In 1991, microbiological contamination was found in 15 percent of meat samples tested, 12 percent of milk, 22 percent of fish, 22 percent of pastries, and 29 percent of fruits and vegetables. Pesticides and mineral fertilizers are widely applied; every sector of agricultural land gets 4.0 kg of pesticides, of which herbicides comprise 2.7 kg. Natrium trichloracetate, dalaprone, simazin, dialen, and fundazol are the pesticides that are most often used. Soil in Lithuania is mostly contaminated with simazin. In 1991, 23 percent of vegetable samples showed increased nitrate concentration, and 1 percent of food samples had enhanced residues of pesticides. In addition, 3 percent of food samples had elevated levels of heavy metals (lead, cadmium, copper, and zinc). Food control laboratories are poorly equipped; they lack reagents and test controls.

Industrial centers and big towns in Lithuania have air contaminated with chemical substances and excessive noise that originates from transport vehicles and some industrial plants. In the proximity of these plants live more than 50,000 people, and among them more than 13,000 children. In 1990, there were more than 27,000 permanent emission points, which emitted approximately 385,000 tons of substances. Automobiles emitted 541,300 tons of contaminants. Lithuania is lacking in air pollution control technology and equipment. Only 83 percent of emitted air is acceptable, as is. In 1990, every eighth air sample revealed contamination above established limits. In the vicinity of large highways, railways, and airports, excessive levels of noise and air contaminants (carbon monoxide, oxides of nitrogen, and lead) were found.

More than 5 million cubic meters of solid wastes and more than 200,000 tons of hazardous wastes all produced annually. Only 7 percent of wastes are utilized, a low percentage because of inadequate management, transport, and disposal.

There are approximately 1.8 million workers in Lithuania. The most developed branches of industry are machine tools, electronics, chemicals, textiles, building materials, furniture, and food products. Many workplaces are contaminated with dust and chemical substances. In 1991, of all workplace air samples tested, 21 percent were contaminated with chemical substances that exceeded standards. Workers are also exposed to noise, vibration, and other hazards. Reported occupational disease cases numbered 370 in 1990 and 327 in 1991, but these data reflect gross underreporting. Poor clinical and laboratory facilities account for much of this underreporting, as do inadequate qualifications of personnel.

Temporary disability caused by diseases was 1,063 days per 100 employees in 1990, and 1,009 per 100 employees in 1991, with the highest rates in the production of textiles, machinery, and building materials.

The Health Care System: The Lithuanian Ministry of Health is responsible for health care. It has all medical institutions at the national level under its direct subordination. Local-level medical establishments are under the jurisdiction of municipalities; the Ministry of Health regulates only their keeping to general principles of medical care.

The health care system consists of 163 hospitals, 23 dispensaries, 331 outpatient clinics, 54 ambulance departments and stations, 45 blood transfusion departments and stations, and 53 hygiene centers. In 1990, there were 458 physicians, 73 percent of whom were women, per 100,000 inhabitants.

Health care system reform has become an important problem. There is an irrational structure of public health institutions. The hygiene centers and environmental centers are complementary and should be merged at the regional level. Integrating hygiene, occupational medicine, food safety, and epidemiology would be very useful for public health; it would provide a stronger mechanism to link more closely activities in environment and health. In addition, the staff at these centers require better organization and equipment.

Priorities in Lithuania for carrying out the European Charter on Environment and Health include protecting workers and improving working conditions, microbiological and chemical safety of food and drinking water, and management of hazardous waste. Special priority should be given to improving knowledge of adverse health effects due to environmental conditions. Training personnel in many disciplines and at all levels in the various aspects of environmental and occupational health is of utmost importance.

OCCUPATIONAL HEALTH CARE IN DENMARK, 1978-1992

Martin Silberschmidt
Euro Health Group Copenhagen
Copenhagen, Denmark

This paper describes the development and implementation of occupational safety and health care policies in Denmark during the past 15 years, in which I actively participated during this entire period. I was responsible for creating a regional clinic for occupational health that has been integrated into an occupational safety and health network. This paper focuses on major aspects of this topic, but it cannot be considered as a complete report of the Danish system.

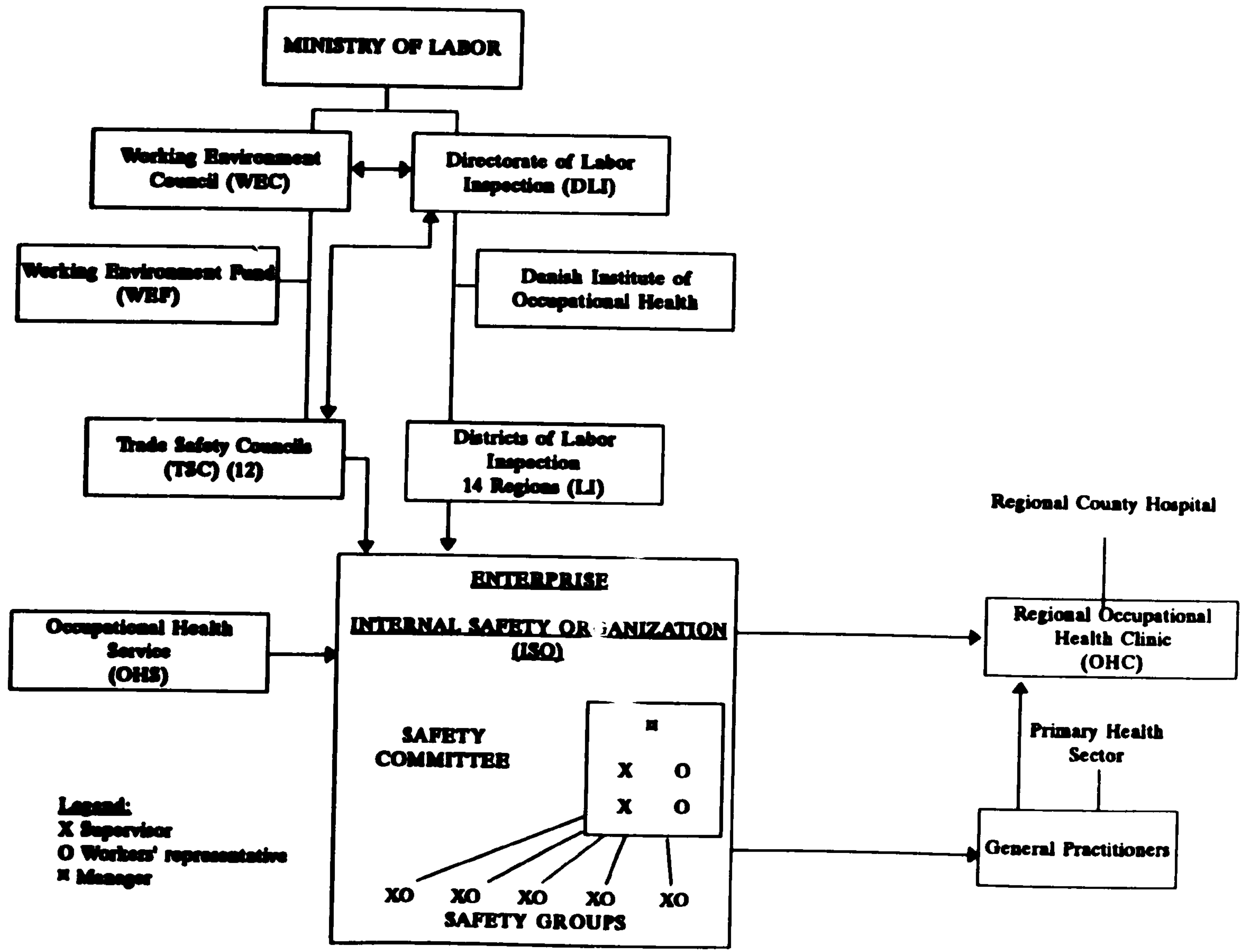
Denmark has approximately 5 million inhabitants and an area of roughly 43,000 km^2, with a population density of 119 people per km^2. Of the 2.1 million workers, 55 percent are men. The private sector employs 71 percent of all workers. Of all workers, 85 to 90 percent are organized. Labor and management are represented by central organizations for negotiations on the labor market, including the working environment. Denmark has developed from an agricultural country to a highly industrialized one. There are about 183,000 industrial enterprises, most of which have 50 or fewer employees. The natural resources of Denmark are oil and natural gas from the North Sea.

Historically, two very important popular movements have had a major impact on cultural and political development in the country: the cooperative movement among farmers from the beginning of this century and the widespread popularity of the "folk high schools." This development might partially explain how solidarity and social equality have had a major impact on the climate of negotiations on the working environment during the past 15 years.

Figure 1 shows the complete network of institutions and organizations that have been established over the years, according to the Danish Working Environment Act (WEA). This act was drafted in consultation with partners of the labor market in the forum of the Working Environment Council (WEC). Enacted in 1977, the WEA has regulations on organization of work, organization of the workplace, work equipment and mechanical installations, and materials. The object of the Act was to create (a) a safe and healthy working environment that at all times should correspond to the technical and social developments in society and the labor market; and (b) a basis to enable the enterprises to solve safety and health problems by themselves under the guidance of labor market organizations and the Labor Inspection (LI). The WEA is a framework act. Specific rules can be adapted to rapid developments in industry and society in general. The act aims to provide a broad framework for further development toward a safer and healthier working environment. Emphasis is given to the prevention of occupational diseases, the "worn-out" worker syndrome, and premature retirement from work.

The detailed rules supplementing the basic principles and aims of this framework act are issued by the Minister of Labor after consultation with the WEC and the Trade Safety Council (TSC).

Figure 1: The Network of the Danish Work Environment Apparatus (WEA)



In this way, the partners of the labor market can have a significant influence on the basic principles and the pace of developments and improvements of the working environment.

The Directorate of Labor Inspection (DLI) is responsible, by agreement with the Ministry of Labor, for the administration of the WEA and for the overall management, planning, and coordination of action on the working environment at a central level. It prepares orders containing detailed rules and guidelines and is responsible for their interpretation, their enforcement, and possible legal actions. The DLI assures the integration of European Community (EC) directives into the Danish WEA. It also provides support to the district LI staff. The Danish Institute of Occupational Health performs workplace investigations, toxicologic and risk assessment, registration of toxic products, research, consultative services, and information and educational activities.

There are 14 regional districts of LI, which have close contact with enterprises and their safety organizations, local authorities, and unions. It is the duty of the districts to assist enterprises by guidance, information, and supervision to respect the rules of the WEA. The inspectors are entitled to hand out improvement notices to facilitate compliance with the law and even prohibition notices to stop production because of imminent danger to life. In the case of an offense by an enterprise, the district labor inspectorate may recommend that the enterprise be charged by the public prosecutor's office.

The WEC includes representatives of the three labor market partners—employers, supervisors, and workers. In the WEC, all contributions by organizations towards a better working environment are controlled (negotiated) and coordinated. The WEC submits yearly recommendations on the improvement of the working environment to the Minister of Labor. The recommendations are based on a draft proposal by the DLI. The WEC controls and coordinates the activities of the Working Environment Fund (WEF) and the TSCs.

The WEF has objectives to promote an improved working environment through research, information, and teaching. The Fund is directed by a board representing the three labor market partners. The financial basis of the Fund is ensured by contributions from employers.

Practical cooperation between the labor market organizations on working environment issues takes place in the TSCs. There are 12 TSCs for the following industrial branches: metals, building and construction, printing, transport, general industry, administration, general services, food, agriculture, social and health services, education, and trade. Each TSC monitors the working environment problems pertaining to its particular branch. It can also assist enterprises to solve environmental problems. Each individual council has its own consultancy service. Recommendations for improving the working environment to be presented by the WEC to the Minister of Labor are first discussed between the TSC and the DLI.

All enterprises with 10 or more employees must set up an Internal Safety Organization (ISO). A safety group must be established for each department or field of activity. The group is composed of the supervisor of the department or field of activity and one safety representative for workers from the safety group. The workers' safety representative is elected by the workers of the department. The safety group is responsible for safety and health activities of the department. The group maintains a healthy working environment at all times, provides adequate instructions to workers, and ensures that regulations are observed by the staff.

Enterprises with 20 or more employees must establish a safety committee. The committee consists of the manager of the enterprise or his or her substitute and two representatives of the safety group members (two supervisors and two workers). The safety committee is responsible for the planning and overall control of the working environment in the enterprise, but it has no power to act on its own. Ultimate decisions on all measures for improving the working environment lie with the employer. On the other hand, the employer is bound to follow the recommendations from an unanimous safety committee. If the employer does not, he or she must present and discuss alternative solutions with the safety committee. All newly elected safety representatives must take part in statutory training sessions of 32 hours' duration.

The Occupational Health Service (OHS) has two main objectives: (1) to prevent occupational accidents, diseases, and disability by improving physically and mentally hazardous work conditions; and (2) to improve the health and safety of employees by directing the preventive activities "against" the workplace rather than "against" the workers. The WEA stipulates that each enterprise must establish an OHS when this is deemed necessary for the safety and health of the employees by the Minister of Labor.

The OHS has been developed gradually since 1978, starting with those branches having the most hazardous working environments. By 1992, 30 percent of Danish workers were covered by the OHS. According to legislation, all Danish workers will eventually be included in the OHS scheme. The main activities of the OHS are advising on purchase and installation of new equipment; performing surveys of the working environment; physical, biological, and ergonomic measurements; health investigations; education; information; and ergonomic guidance.

OHSs have been established in 56 large enterprises, 61 regional OHS centers servicing a variety of enterprises and branches, and 8 OHSs affiliated with only one particular branch. The OHSs were established with economic support from the State. But the main expenses for establishment and the operational costs have been covered by the employers whose enterprises are attached to the particular OHS. The amount to be paid is proportional to the number of employees of the enterprise. Consequently, the size of the OHS staff is determined by the number of employees served by the OHS.

The staff is composed of a core team (manager, engineer, occupational hygienist, and secretaries) supported by other professionals, depending on the branch and the type of problems the OHS is dealing with, such as technicians, physicians, psychologists, and ergonomists. The OHS is operated by a manager under the supervision of a board. The members of the board are representatives of management and labor, in equal numbers. The board approves the budget and hires the staff. Confidential information on labor and on production technology are handled, according to special regulations, in the WEA and are not made available to unauthorized persons.

In 13 of Denmark's 14 counties, a hospital-based, regional out-patient occupational health clinic (OHC) operates within the public health system. Patients are referred to the OHC by general practitioners, regional hospitals, the district LI, the OHS, the TSC, and worker unions. The OHCs are staffed with medical specialists in occupational medicine, occupational hygienists, nurses, ergonomists, psychologists, and social workers. Their main activities are examining patients and visiting their workplaces, assessing cases for compensation, performing research on occupational diseases, providing information, and teaching.

OHCs work in close contact with medical institutions of the primary and secondary health sector, on the one hand, and with regional LIs, OHSs, enterprises, and other local authorities on the other.

Accidents that are due to the working conditions must be reported to the DLI by the employer. Table 1 shows the number of accidents registered in 1987. The overall incidence was around 3 percent. Rates of serious and fatal accidents (not shown in Table 1) were most frequent in the construction and transport branches. Table 2 shows the number and type of occupational diseases reported by general practitioners and OHCs to the DLI during 1988. Table 3 provides data on prosecution cases that were initiated against different partners of the labor market in 1988 because of violation of the WEA.

For the past 15 years, the working environment apparatus in Denmark has expanded considerably. It has been interesting to witness this development from within the system. In many ways, the process introduced a new concept of prevention and clearly placed the responsibility for action within the system. Most people concerned had to get accustomed to this, so changes have been slow and resource-consuming. At the same time, there were economic constraints because of economic problems at the industrial and national level. This process has caused a greater awareness among some workers and managers about the importance of a healthy working environment, both for the well-being of the workers and the productivity of Danish industry.

The LI has become the crank of the entire working environment apparatus and is doing a fine job in coordinating all activities nationally and internationally, and in maintaining a high profile for research and documentation, training, and information. The DLI has signed agreements of cooperation between Denmark and Poland, Hungary, and Czechoslovakia.

The WEC and WEF did not function properly during the first years of the new working environment area. This was due mainly to the difficult negotiation climate between the central organizations of management and labor. In the beginning, neither of the organizations had a clear understanding of, or strategy for, the future development of the working environment in Denmark. During later years, cooperation between the two partners has improved. The WEF has greatly contributed to the dissemination of information on workplace-related issues.

The ISO had a very difficult start. Both employers and workers were against it. After 10 years, the ISO functions well in many enterprises where it has achieved a variety of improvements.

TABLE 1: ACCIDENTS REGISTERED BY THE LABOR INSPECTION IN 1987					
Industry	Number of workers (in thousands)	Number of accidents	Incidence rate per 100	Serious accidents	Fatal accidents
Manufacturing	539	21,945	4.0	2,392	16
Services	405	13,678	3.4	1,469	7
Construction	189	5,881	3.0	1,036	10
Transport	176	5,840	3.0	1,233	12
Agriculture	172	1,160	0.7	233	8
Other	351	4,536	1.4	111	14
Total	1,832	53,040	2.9	6,474	67

TABLE 2: OCCUPATIONAL DISEASES REGISTERED BY LABOR INSPECTION, 1988	
Type of Occupational Disease	Number of Cases
Musculoskeletal	6,260
Skin	2,414
Hearing impairment	3,081
Toxic effects on the brain	969
Respiratory	1,841
Unspecified	2,638
Total	17,203

TABLE 3: LEGAL PROSECUTIONS FOLLOWING VIOLATION OF THE WEA, 1988	
Prosecuted Party	Number of Cases
Employers	233
Suppliers of products or equipment	2
Managers	41
Employees	7
Total	283

Today, workers feel confident and managers have learned how to make the ISO participate in the decisions concerning the working environment.

The OHS is the only private organization within the working environment apparatus. Here, too, the start was very difficult. The whole concept of OHS was new and the practical purpose of the OHS was difficult to understand. Additionally, there were serious economic problems in the start-up phase. Enterprises were reluctant to participate and pay for the OHS. Today, many OHSs have developed into efficient advisory institutions, such as on safe technology, for the enterprises. Many OHSs have also become expert in problem-solving in various fields of occupational health. In some instances, the know-how on safer technology has been exported abroad.

The OHCs have had to compete for existence and funding with curative hospitals. Support for OHCs from the medical establishment has been very modest. Workers and labor unions were the first to acknowledge the work of OHCs; after 10 years, the primary health sector (general practitioners) has recognized the value of having OHCs as referral centers. And, finally, the management too seems to favor OHCs.

In conclusion, major achievements have been: (1) the new working environment apparatus is operative in 40 to 50 percent of enterprises in all regions of Denmark; (2) more people are becoming conscious about the importance of a healthy working environment; (3) several occupational diseases are being prevented successfully, especially hearing loss and diseases due to exposure to chemicals; and (4) some new diseases have been recognized as occupational diseases.

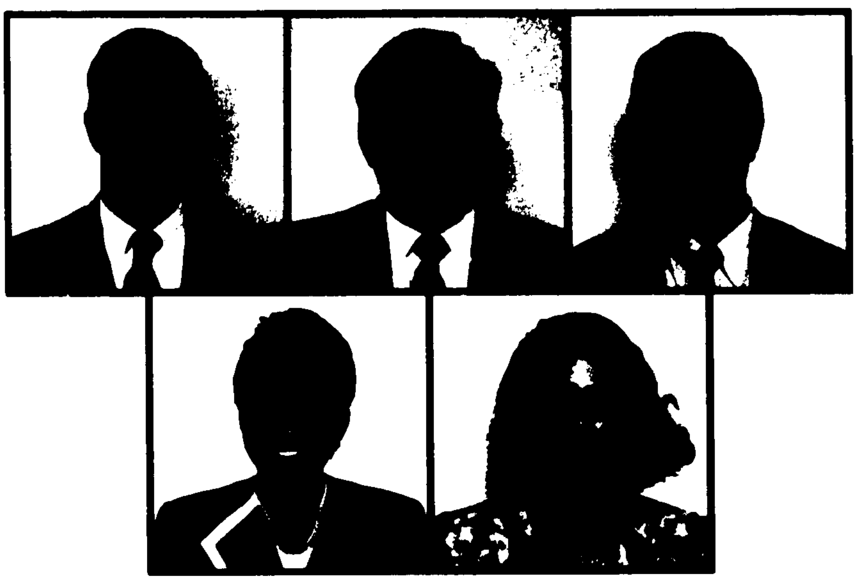
The remaining constraints are: (1) low priority given to prevention by the government and the regional authorities; (2) lack of interest and engagement in environmental issues by the working society at large; and (3) absence of direct communication among several partners of the working environment network at a central and regional level.

Lessons learned have been: (1) it takes several decades to introduce a new system like the working environment apparatus and to make it work effectively; (2) information and communication are crucial for the success of the process and have to be made available at all times at all levels; and (3) the management aspect of occupational safety and health is becoming an important issue.

A breakdown of the remaining barriers between different partners of the network and a strengthening of information and communication technology concerning the working environment are cornerstones for further improvement and the maintenance of a safe and healthy working environment. Ultimately, it seems inevitable that the institutions for environmental protection and for occupational safety and health will have to join their resources in order to work together in a more rational and effective way.

PART ONE: POLICIES AND PROGRAMS

SECTION THREE: UNITED STATES



Top row: Keith Casto, Charles Prochaska, and Kim Hooper.
Bottom row: Beverly Johnson and Monica Becker.

THE AMERICAN ENVIRONMENTAL MODEL
FOR TRANSLATING SCIENCE INTO ENVIRONMENTAL STANDARDS

Keith M. Casto
Pettit and Martin
San Jose, California, USA

The Human Health and Environmental Risk Assessment Approach: The premise underlying a health-based standard is that, regardless of cost and technological feasibility, pollution must be reduced to a level that does not impair public health, welfare, and the environment. The corollary is that sources will be closed if they fail to attain the standard. Congress, for example, has established health-based criteria in setting National Ambient Air Quality Standards in the Clean Air Act and for the control of toxic pollutants under the Federal Water Pollution Control Act, areas in which the consequences of failing to achieve a particular degree of pollution reduction were adjudged especially serious.

The term "risk assessment" as used in the American model means "the use of a base of scientific research to define the probability of some harm coming to an individual or a population as a result of exposure to a substance or situation." The health-based ("receptor-based") statutes that use this approach typically force some action when scientific inquiry establishes the presence of a risk, as when a substance present in the environment, or the workplace, or the food chain, is found to cause cancer in animals. The statutes often require the agency to act according to some protective formula: to establish "margins of safety" or "prevent significant risk" or "eliminate the risk." Historically, EPA has thought it prudent to make conservative assumptions about scientific uncertainties and the extrapolation of cancer data from animals to man. By contrast, "risk management" is the public process of deciding what to do where risk has been determined to exist. It integrates risk assessment with considerations of engineering feasibility and decides how to reduce risk in light of social, economic, and political factors.

The Technological Approach: Terms such as "state of the art" or "best technology" are not always used with consistent meanings. Generally speaking though, the "best technology" test is invoked in the United States to impose upon a facility an obligation to control its effluent or emissions in accordance with the best practices currently in operation in a given industry. A second, more stringent interpretation of the term requires resorting to a control technology known and available in the laboratories and design rooms but not yet generally applied in practice.

In practice, in the United States, the burden of proving what constitutes the "best technology" has been imposed on the regulators because of strong political pressures to avoid plant shutdowns, unemployment, and other disruptions. Thus, the regulators must establish that regulatory requirements are achievable through commercially available means of control and at a cost that will not disrupt the plant or industry.

APPLICATIONS OF THE AMERICAN PARADIGM

Air Pollution and the 1970 Clean Air Act: The Clean Air Act (CAA) relies primarily on a strategy of national ambient air quality standards (NAAQS). The strategy basically has been for the EPA to establish standards defining acceptable levels of ambient (breathable) air pollution. The Administrator must establish national primary and secondary ambient air quality standards on the basis of air quality criteria that demonstrate the relation of various concentrations of air pollutants to their adverse effect on people's health or the public welfare. For each pollutant there are two types of standards: "primary" standards which, in the judgment of the Administrator, "allowing an adequate margin of safety, are requisite to protect the public health"; and "secondary" standards, those which in his judgment are "requisite to protect the public welfare [structures, crops, animals, soils, wildlife, weather, etc.] from any known or anticipated adverse effect associated with the presence of such air pollutant in the ambient air." The "primary" health standard includes protecting "particularly sensitive citizens" such as people with asthma and emphysema and therefore is inclusive of susceptible individuals as well as other adults. The reference to "known or anticipated adverse effects" in setting secondary standards suggests the possibility of a standard that is based on adverse effects that cannot be demonstrated, similar to the adequate margin of safety for primary standards.

Within 9 months after promulgation of the NAAQS, each state was required to submit to the EPA a state implementation plan ("SIP") designed to implement and maintain that standard within its boundaries by establishing emission limits for individual sources. The most important condition was that the SIP provide for attainment of primary NAAQS "as expeditiously as practicable but . . . in no case later than 3 years from the date of the approval of such plan." Secondary standards were to be achieved within "a reasonable time." A SIP had to include "emission limitations, schedules, and timetables for compliance with such limitations," as well as assurances that appropriate state agencies will have the necessary legal authority and resources to enforce the plan. Since the states have different levels of existing ambient air quality, different kinds of stationary sources, and different degrees of mobile source pollution, and because states are permitted broad discretion under the control strategy to allocate the burdens of pollution reduction, different emission limitations may be imposed on similar stationary sources located in different states.

The EPA has promulgated the NAAQS for six "criteria" pollutants: carbon monoxide, particulates, sulfur dioxide, nitrogen dioxide, ozone, and lead. Although all emissions contributing to violation of the standards were to be eliminated by 1975-1977, the deadlines proved overly ambitious and the Act has been amended twice to extend the deadlines, reducing the "absolute" nature of the standards. In 1982 EPA rescinded the hydrocarbon standard on the ground that it was unnecessary.

Because the NAAQS are designed to protect public health and welfare without consideration of economic and technological factors, one commentator described them as amounting to "cost-oblivious public health measures." Given the high costs of developing and implementing the NAAQS, this approach probably is not the best for Central and Eastern Europe. At least in the short run, technology-based approaches as illustrated below by new source performance standards are a better model for Central and Eastern Europe environmental policy.

The new source performance standards (NSPSs) are based on the idea that the beginner has flexibility in choice of location and technology so as to justify the imposition of the highest performance levels. New sources do not require the teaching of "new tricks to old dogs." Ideally, new sources are not part of the problem; they are part of the solution.

The hazardous air pollutant provisions of Section 112 stand out as one of the major disappointments of the Clean Air Act which may provide an example for Central and Eastern Europe of what not to do. The Act authorized the EPA to establish health-based national emission standards for hazardous air pollutants (NESHAP) to protect the public. Sometimes referred to as "air toxics," these pollutants were defined as those "which may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness." Between 1970 and 1990, only eight hazardous air pollutants were listed for regulation, and the EPA promulgated regulations for only seven of them.

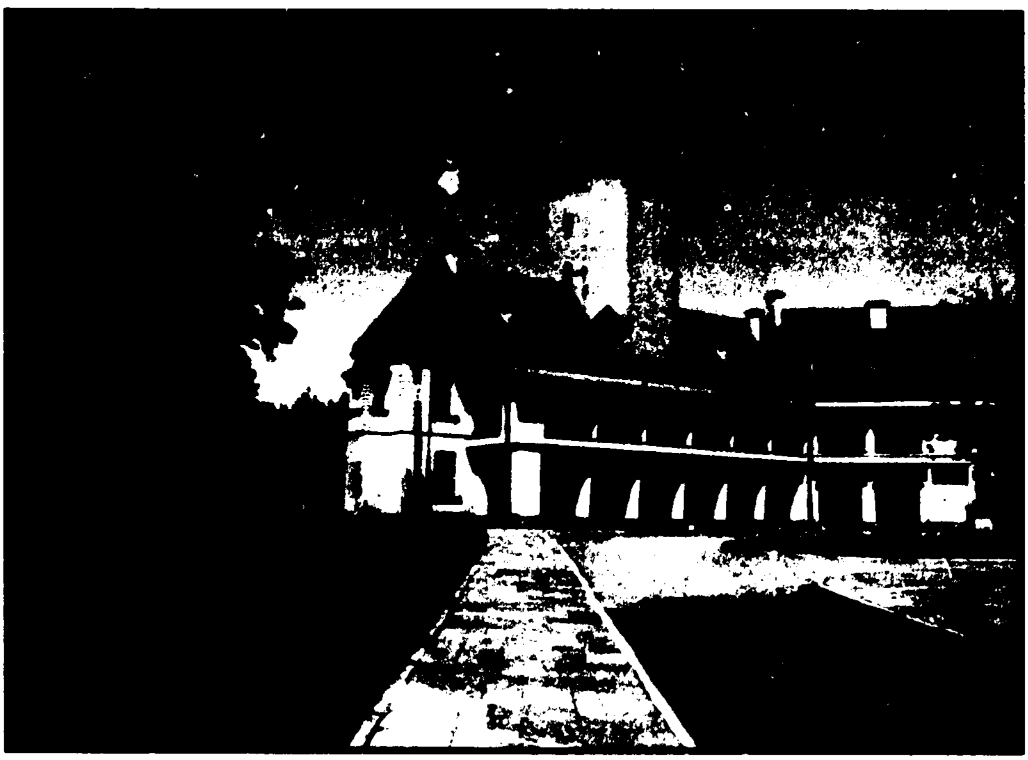
The 1977 amendments of the CAA created detailed requirements for "preconstruction review" and permitting for major new sources and modification in so-called "nonattainment" areas or regions where the NAAQS had yet to be attained. (As discussed below, this "preconstruction review" is also required by the Prevention of Significant Deterioration program.) In nonattainment areas, sources are required to obtain offsetting emission reductions and to achieve the lowest achievable emission rate (LAER).

The general requirements for preconstruction review are in each state's SIP. They are used by the state or local air control agency to determine whether the construction or modification will cause a violation of the state's control strategy or otherwise interfere with the attainment of the NAAQS. Typically, a SIP will require the owner or operator to submit information as to the nature and amount of emissions expected to occur after construction. Air quality data and modeling are used to determine the impact of the source. If the construction or modification will interfere with attainment of the NAAQS, it is not allowed.

The CAA contains a separate program to prevent degradation of air that exceeds the national ambient standards. The basic premise, carried over from a suit brought by the Sierra Club, is that clean air should not be allowed to worsen. Thus, in *Sierra Club vs. Ruckelshaus*, a federal district court enjoined the United States EPA from approving state plans that allow air quality in clean areas to deteriorate to NAAQS levels. The prevention of significant deterioration (PSD) program required preconstruction review of new sources of particulates and sulfur dioxide, allowed certain increments of pollution, and required new sources to meet a general best available control technology (BACT) requirement. The PSD program divides areas of the country that meet or exceed the NAAQS into three classes, each with a separate "increment" of allowable pollutant increases. Only small increases of pollutants are to be allowed in Class I areas, primarily national parks and wilderness areas. Moderate increases were allowed in Class II areas. In Class III areas, increases up to the NAAQS would be allowed to permit industrial growth.

A "major emitting facility" is defined as one of 28 stationary sources listed in the statute that emit, or have the potential to emit, 100 tons per year of any pollutant regulated under the Act, or any other stationary source with the potential to emit 250 tons per year of any pollutant subject to regulation under the Act. The listed major sources include iron and steel mills, municipal incinerators, petroleum refineries, chemical plants, primary lead and zinc smelters, and fossil-fuel boilers. Admittedly, because permits are required by only major sources, and the pollution increment is consumed by both major and minor sources, it is an imperfect program. A PSD permit requires the applicant to meet emission limits based upon BACT for each pollutant subject to regulation under the Act. What constitutes BACT is determined by the permit authority on a case-by-base basis. The Act defines BACT as an emission limit based on the "maximum degree of reduction" of each regulated pollutant "taking into account energy, environmental, and economic impacts and other costs" that are determined "to be achievable for the facility."

Title II of the Clean Air Act governs emissions from "mobile sources," by authorizing the EPA to establish tailpipe standards for automobiles and other vehicles, as well as regulate fuels and fuel additives. The 1970 amendments to the Act reflect the modern approach to the regulation of the automobile. Section 202 authorized EPA to set an emission standard for the model year 1975 requiring a 90 percent reduction for hydrocarbons (HC) and carbon monoxide (CO) from a 1970 baseline of exhaust emissions. A 90 percent reduction for oxides of nitrogen (NO_x) was required by 1976. Section 206 authorized EPA to test or require that the manufacturers test new



The 13th-century castle that was the site of the symposium.

motor vehicles or new motor vehicle engines to determine whether they comply with the tail pipe standards. In addition, Section 211 of the 1970 Act dealt with the regulation of fuels. In particular, the Agency was authorized to prohibit the sale of fuels that would interfere with the performance of any emission control device in general use. EPA was also given authority to control or prohibit the use of fuel or fuel additives in motor vehicles if they would cause or contribute to air pollution that would endanger public health or welfare.

Congress was aware that these standards were "drastic medicine," designed to "force the state of the art." Because there was concern whether manufacturers would be able to comply, Congress provided a "realistic escape hatch": the auto makers could petition EPA for a one-year suspension of the requirements.

The auto industry had difficulty complying with the 1975 and 1976 standards and sought administrative suspensions, which were the subject of litigation and public controversy. The 1977 amendments reflected a recognition by Congress that the problem was more difficult than first thought, and compliance with the CO and HC standards was postponed to 1983. The standard for NO_x was relaxed.

Water Pollution: The Clean Water Act ("CWA"): Prior to 1972, the Federal Water Pollution Control Act prescribed a regulatory system consisting mainly of state-developed ambient water quality standards applicable to navigable waters. The standards for any particular segment of a water body depended upon the uses (such as agriculture, industrial, or recreational) which the state wanted to facilitate. Enforcement was possible only where a discharge reduced the quality of the receiving water below the specified ambient level. This state system failed due to the lack, and perhaps infeasibility, of enforcement because multiple polluters discharging into the same stream or lake presented problems of proof.

In 1972, Congress adopted a totally different approach by enacting the Federal Water Pollution Control Act (FWPCA). The FWPCA amendments of that year established a system of technology-based standards, permits, and enforcement aimed at "goals" of "fishable and swimmable" waters by 1983 and total elimination of pollutant discharges into navigable waters by 1985. Like the Clean Air Act, the FWPCA was amended in 1977 and was referred to as the Clean Water Act (CWA).

The Clean Water Act divides pollution into two fundamental categories: pollution emanating from point and non-point sources. Point sources (defined as "any discernible, confined and discrete conveyance[s]. . . from which pollutants are or may be discharged") are subjected to a two-level reduction standard that seeks to force the adoption of effluent reduction technology. Non-point sources are less amenable to add-on technologies because they require behavior adjustments in land use activities — such as agriculture, mining, forestry, and construction — that cause run-off into streams.

Point sources were initially broken down into municipal sewage treatment plants and industrial discharges. Both types of point sources had to apply for permits issued by either the federal government or a qualified state program. Publicly owned sewage treatments got the benefit of grants, whereas private facilities got only indirect subsidies such as tax abatements. The standards for toxic pollutants were to be treated differently; they were based on health effects rather than on possible levels of effluent reduction.

Point sources may be subject to five different effluent limitations, administered through the National Pollutant Discharge Elimination System (NPDES). The NPDES system basically subjects everything that comes out of a pipe to a permit system. NPDES permits establish the effluent limitations a discharger must meet and the deadline for meeting them. Section 402 authorizes permits for up to 5 years, and the EPA generally issues full 5-year permits subject to modification or revocation for cause.

The most important effluent limitations were the two-step technology-forcing standards imposed on sewage treatment plants and industrial sources. Sewage treatment plants had to provide secondary treatment by 1977 and had to use the best practicable level of technology over the life of the works by July 1, 1980. All existing industrial discharges had to use the best practicable control technology currently available (BPT) by 1977 and the higher best available technology economically achievable (BAT) by 1983. The 1977 amendments extended the deadline for BAT to July 1, 1984, and, more importantly, divided pollutants into three classes: (1) conventional pollutants, including units of biochemical oxygen-demanding substances (BOD), total suspended solids, fecal coliform bacteria, acidity or pH, and oil and grease; (2) toxic pollutants, including a list of 129 specific chemicals; and (3) nonconventional pollutants or those not classified as either toxic or conventional. BAT is still required for toxic pollutants, but conventional pollutants are subject to a less rigorous, new standard of "best conventional pollutant control technology" (BCT), which was to be achieved by July 1, 1984 but later this compliance deadline was extended to 1989. In establishing effluent limitations for conventional pollutants, EPA is to consider, among other things, "the reasonableness of the relationship between the costs of attaining a reduction in effluents and the effluent reduction benefits derived."

Despite what may seem to be an elaborate permitting system, the most ambitious water quality provision of the 1987 Amendments relates to non-point source pollution, that is, run-off from agricultural and urban areas. This has proved to be a major, intractable water pollution problem. States are now required to identify water bodies where water quality standards cannot be met without control of non-point source pollutants, and to establish management programs for these water bodies The plans include "best management practices" for categories of sources and a schedule of implementation milestones.

The Clean Water Act sought to reduce municipal discharge of pollution through a subsidy program that finances the construction of POTWs (publicly owned treatment plants) that meet a national state-of-the-art standard (secondary treatment) and are cost-effective. The basic pretreatment policies are found in Section 307(b)(1) of the Act that obliges the Administrator to propose regulations to establish pretreatment standards for pollutants determined "not to be susceptible to treatment by" POTWs and adjudged not to "interfere with the operation of [the] treatment works." The pretreatment standards eventually promulgated "shall specify a time for compliance not to exceed 3 years" and are supposed to prevent the discharge through a POTW of any pollutant that "interferes with, passes through, or otherwise is incompatible with such works."

Pesticide Use: While the classic approach of the Clean Air Act and Clean Water Act is to set emissions and effluent standards, another strategy is to allow a product to be marketed unless it is hazardous and, if so, the agency then restricts its marketing or use only so far as necessary to protect the public. Federal regulation of pesticides exemplifies this approach. The federal statute regulating pesticides is called FIFRA, which stands for the Federal Insecticide, Fungicide and Rodenticide Act. FIFRA and the Food, Drug, and Cosmetic Act rely largely on the same model: drugs and pesticides should be efficacious; any public health or "environmental" problems are caused by misuse, which labeling will prevent.

Regulation of Hazardous Waste ("RCRA"): A Cradle-to-Grave Management System: Congress adopted the basic outlines of an integrated scheme for responsible waste management in enacting the Resource Conservation and Recovery Act of 1976 (RCRA) with subsequent Amendments in 1984. Included in the Act were key provisions for federal regulation of hazardous wastes (Subtitle C) and a separate program for state regulation of other, nonhazardous wastes pursuant to federal guidelines (Subtitle D).

Section 3001 required EPA to promulgate criteria for identifying hazardous waste "taking into account toxicity, persistence, and degradability in nature, potential for accumulation in tissues," and other hazardous traits such as corrosiveness and flammability. These criteria became the basis for issuing a list of hazardous wastes. If a facility manager determines that he has a hazardous waste, he enters the RCRA subtitle C system. Subtitle C is often described as a "cradle-to-grave" regulatory scheme because it regulates the entire life of hazardous waste, from the point of generation to the point of disposal.

Remediation of Hazardous Waste Contamination ("CERCLA" or "Superfund"): In addition to establishing a "Superfund" to cover the cost of cleaning up sites for which no responsible party can be made to pay, CERCLA creates parallel regulatory and liability regimes. The statute gives the federal government broad powers to clean up sites contaminated by hazardous substances, either by conducting the cleanup itself or by ordering another person to do so. Section 107 imposes liability for the costs of such cleanups on a wide range of so-called "potentially responsible parties" or PRPs. These include current and past owners and operators of the site, persons who transported hazardous substances to the site, and persons who arranged to have hazardous substances transported to the site (i.e., the "generators"). In general, anyone who incurs cleanup costs, whether the government or a private party, may sue to recover those costs from a PRP under Section 107. A PRP may also be liable for damages for injury to or loss of natural resources. However, there is no recovery for personal injuries.

EUROPEAN COMMUNITY APPROACH

Although a thorough discussion of European Community (EC or Community) environmental legislation and/or directives is beyond the scope of this paper, some of the similarities and differences between the EC and United States treatment of pollution problems will be highlighted here.

Air Pollution: Community air pollution legislation has similarly relied principally on two regulatory methods: air quality objectives and emission limits. The pre-1985 legislation focused air quality objectives on lead, sulfur dioxide, suspended particulates, and oxides of nitrogen. Member states were to draw up implementing plans for sources in nonattainment areas and no significant deterioration was to be allowed in attainment areas after implementation of the Community legislation. However, these early efforts were unsuccessful because member states never produced the majority of the implementing plans required.

Since 1984, the Community has changed its approach and now relies more heavily on permitting requirements and technology-based emission limits. But even this new approach has been of limited effect. The permit requirement has been applied only to certain new and modified large industrial sources (listed in Directive 84/360 on Air Pollution from Industrial Plants) and the technology-based emission limits have been developed in other directives for only two types of plants, namely large combustion plants and municipal incinerators. In addition to these two major lines of legislation, the Community has set product standards with a view to air quality protection. It has set sulfur content limits for "gas oil" and standards for both leaded and unleaded gasoline.

Water Quality Standards: The Community has adopted a series of directives setting mandatory and recommended water quality standards dependent on the intended use or purpose of the water: one prescribes standards for surface water intended or used for drinking water; another sets standards for bathing water; and others establish standards for fresh water fish waters and for shellfish waters. These directives oblige the member states to designate the water bodies to which they shall apply and to adopt implementing programs (presumably including the point and nonpoint source regulatory systems) that ensure that the quality standards are met in the water bodies within 5 years of designation.

An important related directive is Directive 80/778 on the Quality of Water for Human Consumption. It sets a series of maximum admissible concentration (MAC) levels for drinking water which member states are to ensure are obtained at the point of consumption. Member states are to ensure "regular" monitoring of drinking water to check compliance with these MAC levels, and ensure that monitoring is at the point the water is made available to the user.

The Community's permit program is designed to cover discharges from all sources to surface waters of two classes of pollutants: "blacklist" and "greylist" substances. The first class, the more dangerous List I or "blacklist" substances, are supposed to be controlled by "emission standards" based on "best technical means available" (BTMA) limit values. The second class of pollutants, List II or "greylist" substances, are to be regulated by water quality objectives and implementing programs developed by the member states.

The Community has recently adopted an Urban Waste Water Treatment Directive, which will require (1) secondary treatment of municipal waste water; (2) prior authorization and pretreatment for industrial waste water discharges to municipal facilities; and (3) compliance of biodegradable industrial waste water discharges going directly to receiving waters with either otherwise applicable rules or applicable permit requirements. By 1994, industrial waste water entering collecting systems and municipal waste water treatment plants must be subjected to pretreatment requirements imposed either by rule or by specific authorization.

Waste Management: The basic Community legislation on waste, the framework Directive 75/442 on Waste, which was adopted in 1975, has recently been revised substantially. The new requirements imposed by the directive amending Directive 75/442 on Waste are to be implemented in the member states by April 1993. Until the new requirements are implemented, the old version applies. The original Directive 75/442 on Waste does little more than create a Community framework for national permitting regimes. It creates a limited permitting requirement extending only to those handling the waste of third parties. It does not provide the detailed operational or waste management standards found in the United States Resource Conservation and Recovery Act (RCRA). These critical details are left to the member states. The amendments to Directive 75/442 on Waste seek to provide a more specific definition of "waste" in order to bring about more consistent national implementation, and impose relatively more expansive permitting and operational requirements. Still, informed commentators have concluded that the amended directive does not go much beyond erecting a more extensive permitting structure that allows for the critical elements of operation, technical, monitoring, and reporting requirements to be left to national determination.

Civil Liability: Presently under consideration in the Community legislative process is an amended version of the proposed Directive on Civil Liability for Damage Caused by Waste. This proposal would hold potentially liable parties strictly liable and jointly and severally liable for harms—personal injuries, property damage, and environmental impairment—arising from the waste. Under the liability scheme of the Directive and CERCLA, the owners and operators of hazardous waste facilities nd the generators and transporters of the waste can be held liable; however, a key difference between the two lies in the fact that, under the proposed directive, a generator that sends its waste to a licensed facility can transfer its liability to the owner or operator of the facility. Where the producer or generator cannot be found or identified, the directive would hold the person in "actual control" strictly liable, thereby creating substantial potential landowner liabilities and underscoring the need for environmental due diligence investigations prior to purchase. In addition, unlike CERCLA which is retroactive, the Directive's liability scheme is intended to be *prospective* only. The proposed directive states that it "does not apply to damage or impairment of the environment arising from an incident which occurred prior to the date" on which it becomes effective. Finally, although the Directive would expand the exposure of manufacturers and landowners in the Community to civil liability, it would not displace existing national civil liability law.

THE EFFECT OF SCIENCE ON POLICY: A PERSPECTIVE FROM THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION IN THE UNITED STATES

Charles Prochaska
Occupational Safety and Health Administration
Washington, DC, USA

The scientific community has an impact in directing safety and health policy in two areas.

First, it has its greatest impact in the areas of regulation formation and enactment, because this is the point where the feasibility of the regulation is considered. Technology and the cost of that technology are weighed against the effect that the regulation has with regard to lives saved and injuries prevented. Second, they affect the levels of compliance and enforcement of the regulations.

In the United States, enactment of an occupational safety and health rule is a slow process, and takes place only after a series of steps where input is received from all segments of society. The Occupational Safety and Health Administration (OSHA) can begin standard-setting procedures on its own initiative, or in response to petitions from other parties, including the Secretary of Health and Human Services; the National Institute for Occupational Safety and Health (NIOSH); state and local governments; any nationally recognized standards-producing organization; employer or labor representatives; or any other interested person.

In the first step of the enactment, we announce our intention to regulate a substance, device or work method, and invite the public to comment. At this point, some of the input is anecdotal, and some is based on research or statistical data. Most of the comments address why a standard should or should not be enacted, and what the scope of the standard should be. The input is analyzed, and the first draft of the standard is proposed.

The second step of enactment requires the publishing of the draft of the standard, again with a request for comments. Comments from the scientific community have a great impact at this point, especially when health standards are being addressed. The scientific community provides information related to the toxicity, permissible exposure limits, methods of monitoring exposure, and effects of long-term exposure. The input from this second publication is analyzed, and a third draft of the standard could be proposed.

The third step of enactment could result in the publishing of another draft of the proposed standard, and could result in one or more hearings where public testimony is given. This could result in a final standard, or this process could be continued to resolve conflicting testimony.

After passage of a standard, there is a possibility that enforcement can be blocked by some type of court action. Anyone can petition the Court for a stay. An example of enforcement of a standard being delayed by the Court is the formaldehyde standard. This standard was stayed 15 times.

During enforcement proceedings, members of the scientific community are sometimes called upon to act as consultants during an investigation, or to support a citation during a court action. The methods used to conduct sampling for toxic substances, the methods used to correct an unhealthy condition, the effectiveness of the corrective actions, and the degree of seriousness of toxic exposures, are all subject to challenge.

While our system of passing regulations may take a long time, and may be somewhat cumbersome, it provides an opportunity for everyone to have their views and input considered.

Route of entry.

MAXIMIZING OPPORTUNITIES FOR PREVENTION: USE OF INNOVATIVE, INTEGRATIVE PROGRAMS IN CALIFORNIA

Kim Hooper
California Occupational Health Program
Department of Health Services
Berkeley, California, USA

I will discuss maximizing opportunities for preventing occupational injuries and illnesses by drawing on our experiences with the California Occupational Health Program (COHP), a prevention program within the California Department of Health Services (state health department). The sizes of the governments and the worker populations in California and the countries of Central and Eastern Europe are reasonably similar. Thus, our experiences may be relevant.

DBCP: Right to Know. In 1977, male employees of a pesticide mixing plant in Lathrop, a small town in California's immense and productive agricultural basin, were made sterile by workplace exposures to the pesticide dibromochloropropane (DBCP). Workers from Colorado, Arkansas, Mexico, Costa Rica, and Israel were subsequently discovered to be sterile from DBCP exposures. DBCP residues were found on peaches, grapes, and citrus fruit; in air; and in most water supplies in central California. Public alarm brought a quick regulatory response: acceptable workplace levels were lowered to 1 ppb by the United States Occupational Safety and Health Administration (OSHA). The Environmental Protection Agency (EPA) banned the use of DBCP in the United States as a pesticide. American companies continued to produce and export the chemical to other countries, however, and reports of sterile workers still emerge from these countries.

Twenty years before the Lathrop tragedy, studies by researchers at a major medical center 100 miles away concluded that DBCP caused sterility in male rats. The rats were made sterile at exposure levels that were very close to those levels that made male factory workers sterile. Although published in the scientific literature, this information was not readily available to the workers. At Lathrop, the discovery of sterility was made by the workers themselves, with the assistance and support of the health and safety personnel of their labor union. The discovery was not made by university researchers who conducted the animal studies; not by the manufacturer who sponsored the studies; not by the formulating company who denied union and employee requests to conduct industrial hygiene surveys and medical monitoring at plant; not by the corporate physician, who denied knowledge of the study data; and not by the government, which lacked the resources to review or communicate results from the published study.

The major lessons of DBCP are: information is needed about workplace hazards; information must be communicated so that it is understandable to target audiences; regulation alone fails to protect; successful prevention incorporates many approaches; and successful prevention involves the entire health community: industry, workers, researchers, health professionals, and government. In response to the DBCP incident, a 10-person program of educators, physicians, industrial hygienists, toxicologists, and epidemiologists was set up in the California state health department to bridge the gap between the university researcher and the workplace: to communicate to the occupational community in understandable fashion the latest research information about toxic exposures and workplace hazards.

California's Workforce and Occupational Community: Our group was faced with a straightforward challenge, similar to that facing countries in Central and Eastern Europe today: large task, few resources. How do we, with our small staff, protect California's 14 million workers from hazards present in a wide variety of industries, ranging from the traditional (construction, agriculture, retail, and services) to the highly technological (aerospace, semiconductor electronics, and genetic engineering)? California's workforce is increasingly multicultural (over 50 percent Asian-, Hispanic-, and African-American by mid-1990), female (over 50 percent), non-union (85 percent), and service-oriented (manufacturing is decreasing). How do we best serve them? Each year 1.5 million occupational injuries and illnesses are reported by physicians, and 600 work-related fatalities occur. How do we best help to prevent these?

Because we confront major problems with limited resources, we must establish priorities. We focus on significant health problems. We seek solutions that are simple and cost little. We seek solutions that are self-propagating, that will perpetuate and spread through economic or other incentives after our efforts have ended. We seek solutions that capitalize on existing networks of health care providers and on existing infrastructures in the occupational health community. We seek solutions that involve as many groups as possible, that interweave the expertise, perspective, interest, and experience of the diverse elements in this community: employers and trade associations, employees and labor unions, public interest groups, occupational/ environmental health groups, community groups, clinicians/health care providers, university/ medical center researchers, and government agency representatives at all levels. If possible, we focus on acute, rather than chronic, health problems because the benefits (improved health) are more readily apparent to the community. Involvement by the community helps to support the program and to foster successful change.

Strategies for Prevention of Occupational Injury and Illness: Successful prevention is a multi-strategy undertaking, usually involving: regulation; standards setting/enforcement; education: broad-based information dissemination/training; and surveillance/intervention. The category "education" is broad, and includes elements of "Right-to-Know," "Right-to-Act," and surveillance/intervention. Successful prevention is a multi-audience undertaking. We link six audiences:

- Employers, employer groups, trade associations
- Employees, unions, COSH groups (committees on occupational safety and health)
- Medical community/occupational health clinicians
- University researchers
- Governmental agencies
- Nongovernmental organizations (NGOs) with concerns for the workplace and the environment.

Before describing two innovative surveillance/intervention projects that may have application in Central and Eastern European countries, I will first briefly summarize how we use the two more traditional activities, regulation and broad-based education, to achieve prevention.

Regulation: Standard-Setting and Enforcement: Regulation in California, the development and enforcement of regulatory "standards" to ensure safe and healthy workplaces, is carried out by the regulatory agency in the state with responsibility for occupational health and safety, "Cal-OSHA." Thus, the airborne concentrations of a substance in California's workplaces are regulated by a Cal-OSHA "standard" for that substance which is a maximum permissible airborne concentration level (Permissible Exposure Level, or PEL, analogous to the European Maximum Allowable Concentration, or MAC).

The great advantage of regulation as a prevention strategy is that it has broad application: it may be applicable to all workplaces in the state and cover large groups of workers, regardless of union membership, gender, nationality, or language group. All can be covered by regulatory "standards." In addition, anyone can petition or recommend to Cal-OSHA that a standard needs changing.

Foyer of castle symposium site.

There are several disadvantages, however, to regulation as a successful avenue to prevention. First, standards-setting is consensus driven, a political process in which economics, health, and technical feasibility are factors in decision-making. Historically, it has been difficult to develop a regulatory climate in OSHA that favors health-based standards. Minor shifts in this direction are followed by severe reversals to non-health-based standards. This is due to opposition from members of the regulated community, who bear the costs of the regulation. It is questionable whether regulatory standards developed in a market economy will adequately protect worker health unless strong economic incentives can be developed that encourage health-based standards.

One such incentive is experience-based insurance premiums for employers, in which the cost of the premium to the employer would be inversely related to the hazard rating of the specific worksite. The hazard rating would be proportional to the exposure levels and/or the prevalence of injury/illness at the worksite. The costs to the employer of complying with the regulation would be offset by the reduced health insurance costs produced by the lowered hazard rating. The company could choose to invest either in higher insurance premiums, or in healthier workplaces. (Unfortunately, the current premium structures for workers' compensation systems in the United States are not sensitive enough to changes in the rates of injuries/illnesses, and offer little incentive for the employer to initiate preventive measures unless the situation is extreme.) Such a system would require standards for workplace exposure monitoring and medical surveillance. Unfortunately, attempts to introduce such standards in the United States have generally been unsuccessful.

Second, regulatory efforts need adequate funds to develop and enforce standards. Although California has the world's seventh largest economy ($775 billion), regulatory activities are not adequately resourced. "Standards" exist for 400 chemicals, but frequently are not health-based: the PELs are more likely to be levels that are achievable by the employer rather than levels that protect the employee. Sixty-seven of California's regulated chemicals are carcinogens, but the PELs are not based upon the cancer endpoint. For the 11 that are regulated as carcinogens, worklife exposures at the PELs produce high excess lifetime cancer risks (1/10-100). Inadequate though many of these standards may be, their enforcement is hardly better: only 20,000 of California's 800,000 worksites are inspected each year for compliance. Finally, PELs have not been established for the 10,000 other chemicals in use in California. Thus, it comes as no surprise that direct regulation of toxic exposures has not, by itself, produced safe and healthy workplaces.

As a starting place, however, we propose to standardize regulation for a list of priority agents on a worldwide basis. A list of priority carcinogens and reproductive/developmental toxicants has been assembled. For some of these, the United States PELs are too high, and produce unacceptably high estimates of cancer risks among exposed workers.

Education/Training: Broad-Based and Targeted: Prevention of occupational injuries and illnesses in California depends greatly upon the success of the second strategy, provision of information. The success of this strategy, however, is dependent upon the presence of an effective responder group. Information, by itself, is insufficient. What is needed is an infrastructure in the occupational community that is receptive, responsive, and able to act on the information given it. The goal of education/training is to create and/or empower these responder groups. Information can be a powerful stimulus for preventive action only when it is presented to comprehending populations in a way that captures their interest and informs them to act. We interpret and communicate the scientific data to the occupational health community in a manner that is sensitive to the language and culture of the target audience. We use a variety of approaches (written materials, video, radio and TV presentations, trainings, symposia, and convening of focus/interest groups).

Hazard Alerts, Fact Sheets, and Booklets: We issue hazard alerts to warn California employers and employees of new or unrecognized health hazards: carcinogenic or reproductive hazards such as methylene chloride, ethylene oxide, glycol ethers, and ribavirin. Distribution of these materials by themselves is not an effective preventive strategy. The written materials must identify protective actions that can be taken (such as change the work practice, improve engineering controls, or petition to lower the standard), and an audience must be targeted that is willing and able to press for this corrective action.

For example, we are issuing a hazard alert on hexavalent chromium, an agent that causes lung cancer in humans, because exposures at the PEL produce unacceptably high estimates of excess cancer risks. Excess lifetime lung cancer risks are estimated at about 1 in 12 for workers with exposures to hexavalent chromium: they spray chromate-containing paints and coatings; handle dry chromate-containing pigments; weld or cut chromium-containing metals, such as stainless steel; and operate chrome plating baths.

To increase its effectiveness and to formulate preventive strategies, the hazard alert is reviewed by focus groups whose members work with hexavalent chromium. The preventive strategies that seem useful are communicated in the hazard alert. Issuance of a hazard alert is accompanied by a press release and extensive media coverage. We mail out 30,000 copies per year of our hazard alerts, fact sheets, and information bulletins, many in languages other than English. As much as possible, we attempt to distribute these materials to organizations, who then copy and further distribute them to their members.

Telephone Response System: Prevention means communication and action. Contacting the receptive audience is the key to prevention. One way to do this, as well as to identify new or unappreciated workplace hazards, is to listen and respond to the concerns of the workers and the occupational health community. We do this through our telephone response system (TRS), in which we respond to questions about health and hazards, and dispense practical information in an interactive manner with an inquiring and receptive audience. As with written materials, responding to the concerns or needs of an organization, such as a trade association, labor union, health advocacy group, medical clinic, or government agency, via TRS increases the likelihood that prevention can occur.

We have responded to questions from 16,000 callers during the last 10 years who have asked us for information about workplace hazards and how to prevent them. We give reliable information on health effects, engineering controls, personal protective equipment, biological and medical monitoring, diagnosis and treatment, product substitution, legal rights, and workers' compensation. TRS has helped us to build constituencies around several health issues, and has served as a significant preventive mechanism for employers, employees, their representatives, and occupational health professionals.

Reproductive Hazards: The proportion of TRS calls that concern risks to pregnancy has increased from 4 percent to over 30 percent over the last 10 years. In our experience, women seek health hazard information from health care providers or other sources because their employers do not provide it, even though they are legally mandated to do so. To better understand the problems facing pregnant workers and health care providers, we surveyed pregnant workers who had called TRS, as well as practitioners who worked with pregnant women. Concerns for potential hazards included lifting, radiation, video display terminals, and specific chemicals or occupations. In one-third of the cases, the employer responded unfavorably to requests by pregnant women for workplace modification. In one-fifth of the cases, the employer required the women to get medical "approval" to continue to work while pregnant.

In response to these concerns, we produced booklets describing chemical hazards to reproductive health and distributed them to reproductive health care providers, unions with reproductive concerns, and governmental agencies in other states. The response has been very favorable. We have also been actively involved in exploring a broader response to these problems, such as developing a reproductive hazards policy.

This is an example of a successful targeted outreach. Concerns of the occupational community were heard at the TRS "listening post." The needs and concerns of pregnant women about workplace reproductive hazards and workplace pregnancy policies were obtained by surveying the callers. A brochure was designed to answer these questions. Information placed in these hands has a powerful preventive effect. Longer-term improvements in work practices are sought via policy development.

Model Programs that Integrate Surveillance with Intervention: Finally, we come to the projects that incorporate all the approaches to prevention. They integrate regulation/education with surveillance/intervention to create holistic approaches to occupational injury and illness prevention. These projects directly couple intervention/education activities to surveillance: the discovery of the cause(s) of injury or illness is directly linked to the reduction of the hazard, as with the infectious disease prevention model. Projects of this type seek to reduce occupational lead poisoning, cumulative trauma disorders (which account for 75 percent of injuries in California), pesticide illnesses, agricultural injuries, and selected occupational fatalities. The target populations for these projects are predominantly Hispanic-American, and prevention activities are undertaken in English and Spanish by our bilingual staff. Two such prevention projects are described below: prevention of occupational lead poisoning, and prevention of agricultural injuries.

Occupational Lead Poisoning Prevention: As is true elsewhere in the world, lead poisoning is a major occupational disease in California. An estimated 240,000 lead-exposed workers reside in the state, many engaged in industries with high lead exposures. Surveillance of occupational lead poisoning in California is possible because of two factors: mandatory biological monitoring and mandatory reporting of all blood lead levels >25 µg/dl. The occupational lead standard requires periodic monitoring of blood lead levels of workers in lead-using industries. California law requires that medical laboratories in California report to the state health department all measurements of blood lead levels >25 µg/dl, accompanied by employer and employee name, employee age, and address. These are compiled in the Occupational Lead Registry, which has had over 23,000 entries since 1987. The registry, however, gives only a partial indication of the pattern of occupational lead poisoning in California, since we suspect that few employers are carrying out the mandates of the lead standard and are monitoring for blood lead levels. As a result, the registry is unlikely to contain entries from all industries in California whose workers are at significant risk of lead poisoning.

Data from the registry are interesting: about half of those affected have Spanish surnames, 95 percent are men, and 67 percent of the reports arise from Los Angeles County. In 1991, about 20 percent of the case reports had markedly elevated (>40 µg/dl) blood lead levels.

Dr. Jerome Wesolowski making presentation on risk assessment.

(16/100,000) are high among farmworkers. We have very little information, however, on how these workers are being injured and killed. This information is needed if we are to take steps toward prevention. Our agricultural injury projects address these needs.

The first project examines a representative (by crop and size) cross-sectional sampling of farms in California to determine two things: the types and prevalence of injuries among farmworkers, and the types and prevalence of hazards on farms. This survey project has purposefully involved everyone who is connected to agriculture in California: university researchers, county agricultural commissioners, agricultural extension officers, the Farm Bureau, growers, grower and shipper associations, and farmworkers and their representatives. Because all have contributed to the design of the project, all become invested in its success.

From the two major agricultural counties, Fresno and Monterey, 100 representative farms per year are selected for evaluation. Six workers are interviewed from each of these farms for injury experience, access to health care, demographic factors, and source of their health care information. Each of these 100 farms is then surveyed for hazards by an agricultural engineer. The net result is a representative profile of the injuries, fatalities, and hazards that occur on California farms.

The second project examines how these injuries occur. All of the fatalities and major injuries in the two counties are captured through a network consisting of all health care programs in the counties that treat agricultural workers when they are injured. The circumstances surrounding each of these incidents are evaluated by an interdisciplinary team to determine potential risk factors, as well as how the incidents could have been prevented.

Written summaries of these incidents are designed as prevention instruments: they have sections that can easily be incorporated as news stories into local newspapers, radio and television news programs, or trade association journals; they are written in a style that compels the reader to seek prevention of agricultural injuries; and they contain recommendations on how each injury or death could have been prevented. One lesson learned: A $30 shield for a power take-off unit is a relatively simple, cheap, and accessible means of reducing amputations and other disfiguring or disabling injuries.

Conclusion: Successful communication leads to action. Appropriate action leads to prevention. Regulation and/or communication about toxic exposures cannot produce a safe and healthy workplace unless the work community is informed and able to act. Constituencies are the lifeblood of prevention. In a market economy and in representative government, those we serve (clients and customers) become those that support us. Listen to, and address the needs of, our constituencies. Ignore these needs and we suffer dire consequences, whether we are in business (bankruptcy), the university (loss of research funding), or the government (budget reductions).

TOXICS USE REDUCTION IN A MARKET ECONOMY

Beverly Johnson
Toxics Use Reduction Institute
University of Massachusetts Lowell
Lowell, Massachusetts, USA

Monica Becker
Tellus Institute
Boston, Massachusetts, USA

Toxics Use Reduction (TUR) is a relatively new concept that was introduced in the United States several years ago. In the United States, our interest in controlling hazardous substances goes back 100 years or more. This interest was primarily directed towards protecting human health. We did not pay too much attention to what hazardous substances were doing to our environment. In the early 1970s, we started to look at what the hazardous substances were doing, not only to human health, but also to the environment. Several environmental laws, such as the Clean Air Act and the Clean Water Act, were enacted. However, these laws and accompanying regulations were primarily concerned with controlling waste, rather than with preventing waste. Then, in the early 1980s, some people in the United States started to question the efficacy of these laws and regulations in protecting human health and protecting the environment. We had made some progress in terms of waste disposal, but, in some ways, we had created more problems than we had solved. For example, we attempted to control waste by building hazardous waste sites that have been found seriously polluting the environment. Love Canal, a community in the state of New York, was so seriously affected by hazardous wastes that the Federal Government had to assist residents to move from the area. Because of the Love Canal and several other similar situations, the public became even more concerned about the environment. Eventually, the federal government passed an even stronger law, the Superfund Act.

At about this time, we began to observe environmental inequities. Many companies that were producing hazardous chemicals and byproducts were located in areas where primarily minority people resided—African-Americans, Asian-Americans, Hispanics, and American Indians. Much documentation of these inequities was provided by the United Church of Christ. Minority people began protesting, saying that cleaning up the mess meant cleaning up the mess for everyone. So, today, there is a new movement known as the Environmental Justice Movement, which says that (1) minority people are just as concerned about the environment as anyone else; (2) they are tired of having their communities used as dumping grounds for toxic chemicals; and (3) traditional environmental movements need to have representation by minority people.

In the early 1970s, the Environmental Protection Agency was created, and we thought that the United States was on its way to clean up the mess that we had made over time. Some progress was made, but other people, mostly environmentalists, wondered if our approach was the most effective approach. They felt that we needed a whole new strategy, a whole new perspective, in terms of how we deal with hazardous waste, and with toxic substances and their byproducts. The strategy they proposed was TUR, which focuses on preventing these hazards from occurring.

TUR is different from pollution control. TUR involves changes inside the factory; it deals with changes within the plant, in production processes, in the way that products are produced, or in the kinds of materials that are used to make the product.

To define TUR strategy, I will use information that was originally developed in the state of Massachusetts as a basis for a state law designed to promote TUR. The following are the four "goals" of TUR—essential elements in Massachusetts in order to be considered performing TUR: (1) reduce, avoid, or eliminate the use of the toxic or hazardous input or raw material; (2) reduce, avoid, or eliminate the hazardous waste generated; (3) reduce risks to workers; and (4) reduce risks to consumers. A company must not shift risks from workers or consumers to the environment, or from the environment to consumers or workers. And a company should not reduce some risks, only to create others.

From a technical perspective, the methods for achieving TUR can be summarized in these ways: (1) **input substitution**: using a different, less toxic, raw material in manufacturing; (2) **changing the formulation of the product**: changing the chemistry of the product to remove toxic ingredients; (3) **changing the equipment**: for example, using mechanical equipment for cleaning instead of using a solvent—in some cases, just upgrading production equipment can reduce the need for solvents; and (4) **changing the process**: changing, for example, the way tanks are cleaned out—instead of cleaning after every new batch of material that is made, batches of similar products are produced consecutively so that there are fewer cleaning steps between batches.

TUR and pollution control are very, very different. In TUR, one is eliminating toxics at the source—not using them at all. In contrast, with pollution control, there may be shifts of hazards from the worker to the environment or to the consumer, or from one environmental medium to another. For example, one may develop a system to capture hazardous waste and send it to an incinerator, but very often what is happening is that there is incomplete destruction of hazardous material in the incinerator, and it is dispersed into the air, and onto land.

With TUR, in contrast to pollution control, there are many benefits in protecting workers, benefits in the community around the factory, and benefits to the consumer. In addition, there are environmental and health impacts associated with the manufacture of toxic raw materials. Therefore, TUR addresses processes "upstream" from the factory. In contrast, pollution control does not address this upstream impact. TUR is responsive to the environment and to environmental problems and it is responsive to workers and the problems that they face with using toxic materials in the workplace.

There are economic benefits that result from TUR. In the United States, it is very costly to dispose of hazardous waste. There are regulations that force companies to put pollution control equipment on their plants. If a company can reduce its use of toxics, it may not have to invest at all in pollution control.

In the United States, laws hold companies responsible for toxic wastes, which cost companies millions of dollars. Future liability costs can be avoided by removing toxic materials from the process.

TUR is still a relatively new approach in the United States, but already companies report a number of success stories:

> Weicher Laboratories replaced an organic solvent with a water-based solvent to coat medicine tablets. It succeeded in reducing airborne volatile organic emissions and generation of hazardous waste, and it saved $180,000 a year by not having to install pollution control equipment, and $50,000 a year in hazardous waste disposal costs.
>
> General Electric's medical systems division replaced a paint removal system that used methylene chloride with a mechanical process using sandblasting, thereby eliminating methylene chloride emissions and waste generation.
>
> IBM rediscovered soapy water as a replacement for solvents.
>
> Minnesota Mining and Manufacturing (3M) switched from a cleaning process using solvents to scrubbing with a type of stone called pumice and reduced hazardous waste by 20 tons annually, saving about $15,000 on the costs of raw materials, labor, and waste disposal.

In 1989, the Massachusetts state legislature passed the Toxics Use Reduction Act, which requires that companies in our state do several things. Three offices were created: (1) the Office of Technical Assistance to help companies make changes in their production processes by using less—toxic materials as much as possible; (2) the Toxics Use Reduction Office, that establishes regulations and monitors companies' compliance with the Act; and (3) the Toxics Use Reduction Institute (TURI) that (a) provides education to a variety of people—schoolchildren, university professors, workers, managers, and others; (b) conducts research; and (c) provides funds to colleges and industries to follow up on TUR strategies. Over the past 2 years, TURI has funded several research projects and presented a number of educational programs.

The money that supports TURI, as well as the two other offices, comes from a trust fund that was established by the Act. This money comes from companies, which are required to pay into this fund an amount of money determined by their size and types of materials used in production. We have been very successful in teaching many people about TUR. We realize that if changes are going to be made in the way products are made, it is important that we educate everyone about how this can be done, because the consumers influence the market and what industries will be doing.

PART TWO: MARKET ECONOMIES AND DEMOCRATIC POLITICAL INSTITUTIONS: CHALLENGES AND OPPORTUNITIES

SECTION FOUR: MARKET I ORCES AND ENVIRONMENTAL HEATLH

Top row: Illés Dési, Metoda Dodic Fikfak, Fina Kaloyanova, and Yuri Kundiev.
Bottom row: Allen White, Beth Rosenberg, and Daniel Thau Teitelbaum.
Pictured earlier: Monica Becker.

PROBLEMS OF PROTECTING THE ENVIRONMENT AND WORKERS' HEALTH DURING TRANSITION TOWARD A MARKET ECONOMY IN HUNGARY

Illés Dési
Albert Szent-Gyorgyi University Medical School
Szeged, Hungary

Hungary and all of the other Central and Eastern European nations are experiencing significant economic and social changes. Seeing these changes, we have to ask ourselves whether Hungary would be able to develop economically without sacrificing environmental health and work safety.

The natural environment has been spoiled in our country as a consequence of the forced industrialization that began in the 1950s. New factories grew out of the empty meadows, without establishing protective measures. The extensive and quick establishment of industry got high priority at the expense of the health of the workers and the general population. All environmental and workplace data were handled as top secret; thus, authorities succeeded in hiding the true conditions from the citizens.

The new administration inherited a heavy burden from the former regime, in practically all sections of life, including the abused and ruined environment. Not much had been done during the years of the previous regime to prevent pollution; thus, people are endangered today by hazards that are not currently accepted in Western societies. Hungarian industry is backward, including in environmental safety.

The great questions are: Will our new society be able to develop suitable environmental guidelines? Will the new private owners want to follow them? Will privatization solve or worsen our environmental problems? There is a danger that recent changes in production and sales will cause growing difficulties in the domain of environmental and industrial health.

The most outdated and uneconomical factories are now disappearing. Industrial production has sunk by 18 percent, causing growing unemployment. In Hungary, there are 500,000 people without work; the unemployment rate is 9.3 percent. Last month (May 1992), it was 8.9 percent. It is steadily increasing. Of our 10 million people, 1.5 million people are living under minimal financial circumstances; 50,000 are homeless; and 2.5 million are retired people struggling to survive on their miserable pensions. Handicapped people number 500,000.

Having a large population without work in financial uncertainty and having retarded industrial development, Hungary finds it nearly impossible to give priority to environmental problems. The challenge for people is to get a job and make money; they are not concerned with the state of the environment.

To solve our environmental problems we need enormous amounts of money. But from where? Last month, the deficit of the national budget increased by 20 billion forints to 78 billion forints situation is the same in agriculture. Great State and collective estates have been split into small private farms, some of whose owners lack the money and knowledge to handle pesticides properly.

Now some data on our environmental situation. There are 17,000 air-contaminating sources registered in the country. Others are still hidden. Annual emission of sulfur dioxide is 1,200,000 tons; of sulfur, 600,000 tons; of oxides of nitrogen, 73,000 tons; of carbon monoxide, 40,000 tons. Acid rain damaged 150,000 hectares (375,000 acres) of woodland, about 10 percent of all our forests. On about 11 percent of the territory of the country, where 44 percent of the population lives, the ambient air is of poor quality and unhealthy to breathe. Damage to the environment due to contaminated air amounts to 15 billion forints a year.

Our cars are old, with many having two-stroke engines. Carbon monoxide exhaust of half of them is greater than permitted by international standards. A new law prescribes paying higher duties and taxes in the future for old cars that are imported. Lead-free gasoline is practically the same price as leaded gasoline, which does not encourage anybody to use it.

Between 1973 and 1983, the number of new patients with bronchitis increased 2.5 times. Deaths due to lung cancer grew 3 times from 1955 to 1981. Air pollution may be responsible for much of this.

Possibly an even greater problem is the quality of our surface water, nearly all of it coming from abroad. Out of 100,000 controlled water samples, 26 percent were bacterially and 38 percent chemically contaminated. Our sewage channel system is only about half as long as the drinking water duct lines.

In the agricultural sphere, the area of land affected by erosion is about 3.7 million hectares. The owners of about 10 percent of all the farmlands (250 farmer units) are bankrupt. Contamination of soil is diminishing. However, this has happened because farms were partly unable to buy pesticides and fertilizers.

Generally, fat provides 40 percent of human energy in Hungary. The maximum recommended percentage is 30 percent. Daily cholesterol intake is 530 mg for men and 420 mg for women. The recommended maximum is 300 mg per day.

In consequence of these and other lifestyle problems, life expectancy of men is the shortest in Europe (65.5 years); life expectancy for women is 73 years. Deaths due to heart and circulatory diseases account for about 50 percent of all mortality, and malignant neoplasms account for about 20 percent. It is well known that a contaminated environment is a causal factor of many tumors. The poor health status of the population and its impact on the economically active workforce is seen as an important obstacle to the country's economic recovery.

A favorable development is the recent reorganization of the public health service. A hierarchical system was established under the control of the Ministry of Welfare. It has three levels: (1) a national public health center, consisting of seven pre-existing national institutes; (2) an intermediate level of 20 county institutes; and (3) 146 municipal institutes. The chief medical officer of the country and those of the counties have been appointed. The service is empowered by law, and has the right to intervene on any public health problem, including environmental and occupational health problems. It has quite good financial resources and modern equipment.

Teaching of public health at universities is also under reorganization, with the help of a West European (Commission of the European Communities) Tempus grant, which enables us to get new equipment and to send our teaching staff abroad for study. We are very fortunate to again have democracy and a market economy, even though this transition is difficult and takes a long time. The vast majority of the problems enumerated above have been inherited from the previous regime and accumulated during the past 40 years. These problems can be solved, step by step, over a lengthy period of time. Tiresome and hard work is ahead of us if we are to achieve our goals. But I believe that we will succeed.

Engraved door of church.

EFFECTS OF IMPORTED TECHNOLOGIES ON HEALTH: SLOVENIAN EXPERIENCES

Metoda Dodic Fikfak
Institute of Public Health and Social Welfare
Ljubljana, Yugoslavia

Having become independent, Slovenia now wants to become an economically developed country. It is in the process of restructuring its socialist industries. As there is not enough investment capital, it is reasonable to fear that the principles of ergonomics and sound ecological technologies may be given up, even though the restructuring of the economy is a unique opportunity for changes. These changes would include not only legislation, but also actual implementation of new measures supported by law, inspection, and sanctions. In the former state, legislation was not bad, but hardly anyone complied with it. From the short-term perspective, it simply did not pay, and everybody was interested only in immediate results—or, in other words, the price.

In the new state, a good law on ecology has been passed, consistent with the West European laws. Yet is came as no surprise that the first question that an American expert put to our minister of the environment was whether the law was drafted in collaboration with the Government, the Ministry of Justice, and the Ministry of Finance? The answer was no.

Slovenian borders had been tightly closed for many years. Since the opening of our borders, outmoded foreign technologies have often been imported. These technologies either had been banned in the West or were deficient ergonomically. Now we have to deal with health effects that could be considered harmful consequences of imported technology. I would like to present two cases of this type in Slovenia, one ecological and the other ergonomical.

First Case

In August 1983, it was found that water and sediments from the River Krupa contained polychlorinated biphenyls (PCBs)—in the water 300 ng/l, and in the sediments 55,000 ng/l of dry matter. (The USA standard is 1 ng/l.) The measured rate of pollution showed this was one of the most PCB-contaminated water sources in the world. The pollutant was coming from the capacitor-producing plant of a company in Semič; PCBs were used for impregnation. The use of PCBs started in 1962. In 1985, the company stopped using PCBs. PCBs were therefore widely used, and the environment and people were being contaminated with it, although the legislation in force at the time disallowed it: (a) the decree on the maximum allowed concentrations of radionuclides and dangerous substances in the interstate and international water flows and the coastal sea of Yugoslavia stipulated that these waters not contain PCBs; and (b) the law on circulation of poisons explicitly stipulated that on the territory of the former Yugoslavia, the traffic and use of substances and preparations considered poisonous by that law were prohibited if the use of these substances and preparations was prohibited in the country producing them. At the time, these substances were being imported from France.

Chiefly because the findings stirred up great excitement and because of great public pressure, in April 1985 Slovenia enacted a regulation on safety measures to be observed in handling substances containing polychlorinated naphthalenes and polychlorinated triphenyls. Since then, the company does not use PCBs. Once the pollution was discovered, it was found that PCBs were being conveyed from the polluted scurce predominantly by air. Of 121 workers who were directly exposed to PCBs and trichlorethylene at the same time, three were discovered to have occupational diseases, one had skin disease and two, liver disease. In the same group of workers, 15 percent had chromosome disorders, whereas in the control group (unsuitable, as it was composed of workers from the nuclear power plant) the rate was 4 percent. Chromosome mutations discovered in workers exposed to PCBs were directly related to the period in which they were exposed to the agent; also statistically significant were correlations between the level of PCBs in blood and the percentage of chromosomal disorders. At that time, acute toxic, carcinogenic, and teratogenic effects of PCBs on the population of the region were not discovered. However, as far as the epidemiological features are concerned, the survey conducted at the time had, chiefly because of insufficient finances, several weaknesses: there was no control group of non-exposed people nor any comparisons with Slovenian regions less polluted or not polluted with PCBs.

Because PCBs may have carcinogenic and mutagenic effects and because of considerable pressure from both the public and politicians, an epidemiological survey was begun in 1991 even though PCB levels in air, soil, water, sediment, food, and plants had dropped to permitted values. The first part, in which a comparison was made between the death rate due to cirrhosis of the liver from 1986 to 1990, showed that a region with three polluted communities, as compared to the rest of Slovenia, had a statistically significantly higher death rate due to cirrhosis of the liver. However, this region is among the highest in alcohol consumption in Slovenia. In the second part of the survey, the medical history of those who died of cirrhosis in this region in this period will be examined. Certain parameters will be compared with those from a sample of the deceased from the same disease elsewhere in Slovenia. It has been clear to us that the most would be done for the people of the most contaminated communities if all of them could be examined and any of their long-latency diseases could be detected early and hopefully treated. Regrettably, there is no understanding or money for this.

If the laws in force at the time had been observed, an ecological problem of such magnitude could not have occurred, but nobody admitted breaching the laws or acknowledged great material, health, and psychological consequences.

Second case

The annual rate of sick leave absence in Slovenia is approximately 5 percent and it varies with current socioeconomic status. In 1990, for example, absence from work due to illnesses and injuries was the highest in the past 10 years. That was during a period of bankruptcies and increasing unemployment. Thus, those who remained at work in 1991 were the youngest and best workers, highly motivated to show their industriousness and retain their posts. This led to the rapid decline of sick leaves in 1991. Among all illnesses, muscle, bone, and tissue impairments stand out. On the basis of diagnosis analysis and of our knowledge of types of work in industry, we can assert that most diseases probably arise from non-ergonomic work environments. Modern machines and equipment imported from industrially developed countries usually are ergonomically sound, but locally manufactured products are not. Two negative aspects are present too often: (1) an ergonomic component can be utilized only after an element is integrated into the system, but the element is only partly imported; or (2) the user is not trained to take advantage of the ergonomic component, especially because it is not essential for proper functioning of the machine in a technical sense.

Among workers usually absent from work due to muscle, bone, or tissue conditions are video display terminal (VDT) operators. Based on a study presented below, it is obvious that the main cause of difficulties are non-ergonomic tools, either imported or locally manufactured, as well as the work practices of operators that are inadequate due to the lack of training.

VDT operators usually work in large rooms with many terminals. This work appears ordinary and does not attract special attention of physicians, employers, or furniture manufacturers. It may even seem that these workers do not have "rights" to develop subjective difficulties from this type of work. We focused on these workers only after we learned of their frequent complaints of piercing pain in the neck and back, "pins and needles" sensations in the arms, and stiffness of their shoulders. Older VDT operators suffered from carpal tunnel syndrome, cervico-brachial syndrome, and lumbago. All had identical working conditions and there was a noticeable increase in absence from work due to these conditions.

Assessment of the work environment of VDT operators in the Ljubjanska Bank showed sustained isometric strain on the neck and upper arm muscles. Job procedures are repetitive and identical, often for several months or longer. The operators take identical sitting postures daily. They maintain the same position of text and keyboard, and the arrangement of tools does not change either. Measurements of anthropometric angles showed that the body posture of operators does not change during work. At the start of work in this job, the body posture, typing method, manipulation of tools, and eye movements are consciously controlled; but in time, workers develop the motoric model inscribed in the brain. Therefore, every change of the adopted posture and typing manner requires sustained re-education. The old pattern continues to interfere with the new, yet similar, body posture, so the operator must consciously modify body posture. For the operator, the adjustment to the new pattern is more strenuous than learning itself and requires determined persistence. A stereotypical posture that places continuous static strain on the same muscles causes ache and fatigue in the affected muscles, while the unilateral strain on the spine causes constant pressure on the edges of the elastic intervertebral discs, thus reducing the perfusion of nutrients into the discs. Such continual and prolonged strain eventually leads to the degeneration of the discs. With operators, the parts most frequently affected are the neck and lumbar regions. Degeneration of discs and narrowing of intervertebral spaces causes narrowing of veins and nerve endings, thus leading to neurological and circulatory disorders.

The study showed that the subjective difficulties of operators depend on the anthropometric angles which, in turn, depend on furniture type. Neck conditions are directly proportional to the angle of neck inclination. In non-ergonomic work environments, this angle was large because of the text laid on the desktop. Status of the right shoulder is proportional to the abduction angle of the right unsupported upper arm. Problems with the right forearm are proportional to the angle of the arm extension, which, in turn, depends on the height of the keyboard and ulnar deviation of the right arm related to the position of the keyboard.

The obtained values of anthropometric angles in the work environment adapted to meet ergonomic requirements, when compared to those in the same work environment prior to adaptation, showed a statistically significant reduction of neck inclination and head rotation as well as the increased inclination of the body and the angle between the upper arm and forearm. The text was placed on the text holder and positioned in front of the eyes, while the screen was lifted to the eye level. This prevented inclination and rotation of the head. The operators were given ergonomic keyboards, which reduced the extension of the arm, whereas correct position of the keyboard eliminated ulnar deviation. In addition, the operators were given a properly adjusted ergonomic chair. An upright and unsupported, or forward-bent, spine is responsible for subjective difficulties with the back, shoulders, and even the neck.

Electrical muscular activity of the lumbar paravertebral muscle depends on the type of the chair, and especially on the back and shoulder support, as well as on the sitting posture. The optimal angle between the legs and the back, when sitting with the back supported, is 95 to 110 degrees. We were further interested in the electrical force of the muscles in the most frequently affected isometrically strained muscles (right trapezius, right deltoid, and right biceps brachii) in the given non-ergonomic work environment.

Can we anticipate the development of the subjective difficulties on the basis of measurements alone, and can we expect to solve the problem solely by adjusting the existing work environment so as to meet ergonomic requirements? We used an electromyograph (EMG), specially constructed and adapted to the field work to measure the intensity of muscle activity and muscle fatigue. The apparatus enables observation and direct recording of work operation during EMG monitoring. In this way, we could exclude all operations that interfere with job procedure and are not typical of the routine. We observed the electrical force of the muscles in the ergonomic and non-ergonomic environments.

Our measurements showed an increased electrical force in the right trapezius in the non-ergonomic environment, in comparison with the ergonomic environment. On the basis of measurements, we estimated that either the operators have developed conditions already or they stand a great chance of developing them soon. The questionnaire confirmed our estimations. In the ergonomic work environment, the electric muscular force and the torque were reduced so much that the intensity of strain, even when prolonged, would probably not cause subjective difficulties. The findings are so significant that both furniture manufacturers and the employers should observe them.

Thus, what is an adequate ergonomic therapy for the terminal operators?

1. The use of the ergonomic chair is indispensable. The height of the chair must enable the position of the elbow to match the mean height of the keyboard. The support for the back must be adjusted to the height of the lumbar region.

2. Every operator must have the foot rest which can be adjusted to type of shoes or heels.

3. The text must be level with eyes, placed onto a text holder with a mobile line indicator, which is moved by pressing a pedal.

4. The shape of the screen, its dimensions, and its contrast must meet ergonomic requirements.

5. The mean height of the keyboard must be up to 3 cm; the keys should have slight concave depression and should respond to appropriate pressure.

6. The right forearm should be supported.

7. Before starting work, the operators should learn how to sit properly and how to adjust the furniture and tools.

Everything seems rather simple: if we imported ergonomic tools along with instructions for their use, and if we taught workers how to use them, we would surely have healthier workers. However, Slovenian experts, shop-floor engineers, and specialists in occupational medicine are still not committed to ergonomics. Unfortunately, the bridging of the gap between learning and practice is still reserved for enthusiasts. We are sure that the ergonomic requirements will not be satisfied unless regulated by law. As with ecological regulations, the inspectors should, in collaboration with the authorized experts, report on non-ergonomic work environments and set terms for their improvements. We must be aware that work incapabilities due to impairment of the extremities are all too prevalent.

If we import technology, we must also learn to appreciate quality of life—not only survival. We must consider the costs and the benefits of imported technology.

SAFE USE OF PESTICIDES DURING SOCIAL TRANSITION IN BULGARIA*

presented by
Fina Kaloyanova
Institute of Hygiene and Occupational Health
Sofia, Bulgaria

Agriculture is one of the most important branches of Bulgaria's economy. Use of agricultural chemicals, such as pesticides, fertilizers, and veterinary chemicals, is very intensive. During the years of a central economy and cooperative farming in Bulgaria, use of pesticides was mainly organized and performed by specialized groups of qualified persons. Sanitary registration and a health surveillance system, including biological monitoring of cholinesterase activity of exposed persons, was introduced more than 30 years ago.

With the law for privatization of agricultural land, problems related to pesticide use must be solved by introducing a new system of management. Public awareness of adverse effects of pesticides has increased considerably.

The principal goals of our project are: (1) development of new regulations for pesticide registration to promote safe use of pesticides among private farmers; (2) development of training courses for different categories of people involved in pesticide application or control as well as for nongovernmental organizations; and (3) preparation of a manual and other training materials.

RESULTS

New regulations: About 500 different formulations of pesticides, based on 226 active ingredients, are now registered for use in agriculture in Bulgaria. New criteria have been developed for classification of pesticides in three use categories. A complex of health and environmental criteria are used, based on acute, oral, dermal, and inhalatory toxicity; skin and eye irritation; sensitization; teratogenicity; mutagenicity; carcinogenicity; evidence of acute poisoning in humans; medical treatment possibilities; persistence and mobility in soil; bioaccumulation; and other factors.

A special expert committee responsible for sanitary registration of pesticides reevaluated all registered pesticides in Bulgaria and reclassified them. Pesticides in the first group are the most hazardous and must be used only by people with professional training in pesticide use. Pesticides from the second group must be applied only by persons who have a license and who have attended a training course. The third group of pesticides may be applied by persons not specially

* Authors of this paper F. Kaloyanova, M. Tasheva, A. Baynova, and T. Vergieva. This project was supported by the Regional Environmental Center for Central and Eastern Europe.

trained, but informed at the place where pesticides are sold about their proper use as well as the health and environmental risks of misuse. A regulation specifies that pesticides are sold only after filing a declaration with name, passport number, license number (for Groups I and II), and type and quantity of pesticide purchased. The purchaser is responsible to comply with the requirements of the use categories.

Training courses: Training programs are based on five modules: legislation, technology, toxicology, prevention, and ecology. There are two levels of required knowledge, dependent on the function performed.

Training materials: Several kinds of training materials are now under preparation:

- A manual with chapters on classification of pesticides, choice of pesticides, integrated plant protection (integrated past management practice, equipment for pesticide application, application in special settings), veterinary use, general data of pesticide toxicity, packaging and labeling, storage, disposal, safe use, medical surveillance, personal hygiene and protection, prevention of dangerous residues, animal protection, environmental protection, fire and accident prevention, legislation, education and training, and responsibilities. A special supplement for children is under preparation.

- Material safety data sheets will follow a similar format. All information on each pesticide will be included on four pages.

- Training materials with questions for discussion and case studies, and tests to check required knowledge.

- Informational material will include a series of popular issues on safe use of pesticides broadcast by a radio program dealing with ecological problems, and materials for discussions in children's circles.

PROBLEMS IN THE USE OF PESTICIDES IN AGRICULTURAL PRIVATIZATION IN UKRAINE

Yuri I. Kundiev
Institute for Occupational Health
Kiev, Ukraine

Over the past 30 years, use of chemicals for plant protection in the former Soviet Union had been constantly increasing. The application of pesticides grew significantly due to introduction of industrial technologies into agricultural production. In 1987, the application of pesticides was estimated at $1.1 billion. The annual increase of pesticide consumption from 1977 to 1987 was 9 percent.

The volume of pesticides applied in the former Soviet Union was higher than the volume produced. Large amounts of pesticides (new preparations, in particular) were imported from Great Britain, Japan, Germany, and other countries. In 1991, because of economic difficulties the situation changed—the import of pesticides sharply decreased.

Now and in the future, policies concerning pesticides and their management, including regulation on their safe use, will not be controlled centrally, as was done in the former USSR. Independent countries will make these decisions, revising hygienic regulations, taking into account regional ecological peculiarities and results of epidemiological studies. This process has already begun in Ukraine.

In Ukraine, the concept of integrated plant protection has been approved, with protection done by all possible means. Chemical methods are allowed only when non-chemical methods are not effective. Ecological and economic considerations are important in determining which types of methods are used.

The concept of integrated plant protection is of primary importance for individual farming. The data on pesticide load per hectare (ha) of plowed field demonstrate levels of environmental contamination. The average load in recent years in the USSR amounted to 0.4-3.9 kg/ha. One-fifth of sampled soil is contaminated with DDT or its derivatives, and considerable amounts of DDT are found in breast milk, blood, and fat tissue of people.

In recent years in Ukraine, ecological problems have worsened considerably, often in association with wide application of pesticides. In special publications and in the mass media, the expediency of pesticide application for intensification of agriculture is now being questioned. Some people argue that without pesticides it is not possible to implement industrial technologies for crop cultivation and to preserve yields; others argue that pesticide application becomes ever less effective and that, in time, resistance to pesticides is usually developed by the target species.

Many negative after-effects of pesticide application have been documented. They are mainly associated with violation of scientifically-grounded recommendations on pesticide application. Sometimes, they are applied improperly with resultant increase in health risks. In the Commonwealth of Independent States (CIS), including Ukraine, choice of pesticides is now limited; it needs to be broadened, allowing interchange among pesticides, avoiding global contamination of the environment, as occurred with DDT.

New pesticides, such as synthetic pyrethroids and pheromones, are being produced and applied on a small scale. Application equipment and techniques generally follow hygienic guidelines.

Problems with pesticides in Ukraine reflect a striking example of lag in practical application of scientific knowledge. More than 20 years ago, toxicological and hygienic criteria for pesticide selection were developed and approved in many countries. Maximum allowable concentrations (MACs) for the working zone and for atmospheric air, and maximum permissible levels for food products were developed. MACs for water reservoirs and the soil have been substantiated and now have the force of standards. The sanitary rules on storage, transportation, and handling of pesticides have been established for all pesticides that are applied. However, these regulations are often violated, and the efficiency of State supervision remains poor.

Our task is to eliminate this gap, to raise the culture of work and the responsibility of all workers involved in handling agrochemicals. It is necessary to take a comprehensive approach in solving problems associated with intensive use of chemicals in agricultural production. In view of this, new scientific trends have appeared:

- Revision of registered and applied pesticides, with due consideration of the ecological situation in each region (for example, now after the Chernobyl accident, we must decide what pesticides should be applied to soil contaminated with radionuclides);

- Substantiation of new ecological and hygienic standards, and improvement of existing ones;

- Development of ecological and hygienic prognoses for certain regions in relation to further pesticide application; and

- Improvement of methods for biological monitoring of chemicals affecting workers and residents in rural areas.

Due to changes in the agrarian policy in Ukraine because of social and economic changes and development of individual farming, many new organizational and practical challenges relating to safe use of pesticides need to be met. We should consider differences in working conditions at State or cooperative farms as compared with farms operated by individuals. An important focus is development of a network of measures, including economic sanctions, for encouraging existing regulations. Extensive introduction of good agricultural practice is very important.

Good agricultural practice and a system for integrated plant protection are economically profitable and also allow significant decrease in pesticide application. All regulations aimed at reducing pesticide use must be recommended first for individual farming. It is appropriate (a) to study the experience of such countries as Denmark, the Netherlands, and Sweden as well as Ontario Province in Canada, where regulations have reduced pesticide use in agriculture by 50 percent; and (b) to recommend adaptation of these countries' regulations in Central and Eastern European countries.

The experience of countries where there are two lists of pesticides recommended for application—one for large State and cooperative farms and the other for individual farms—should be studied.

On the basis of laws, we can raise the efficiency of State sanitary supervision of pesticide application in agriculture.

Dr. Joe LaDou receives honorary membership in the Ukrainian Institute of Occupational Health from its director, Dr. Yuri Kundiev.

ENVIRONMENTAL HEALTH AND SAFETY IN THE TRANSITION TO MARKET ECONOMIES IN CENTRAL AND EASTERN EUROPE: THE ENTERPRISE PERSPECTIVE

Allen L. White
Tellus Institute
Boston, Massachusetts, USA

The legacy of environmental health and safety (EHS) mismanagement in Central and Eastern Europe has unfolded steadily during the last five years. Indiscriminate hazardous waste disposal, harmful exposures of workers to chemicals, and uncontrolled air and water discharges are pervasive features of post-World War II industry practices. While the full extent of health and ecological damages will remain the subject of inquiry for many years to come, it is clear that a fundamental overhaul of EHS practices will be necessary to elevate the region's performance to a level equivalent to Western industrial standards. This task will require the dedication of government, the activism of environmental and citizen groups, the pressure of trade unions, the insistence of domestic and international lending institutions and, most importantly, the commitment of industrial enterprises themselves.

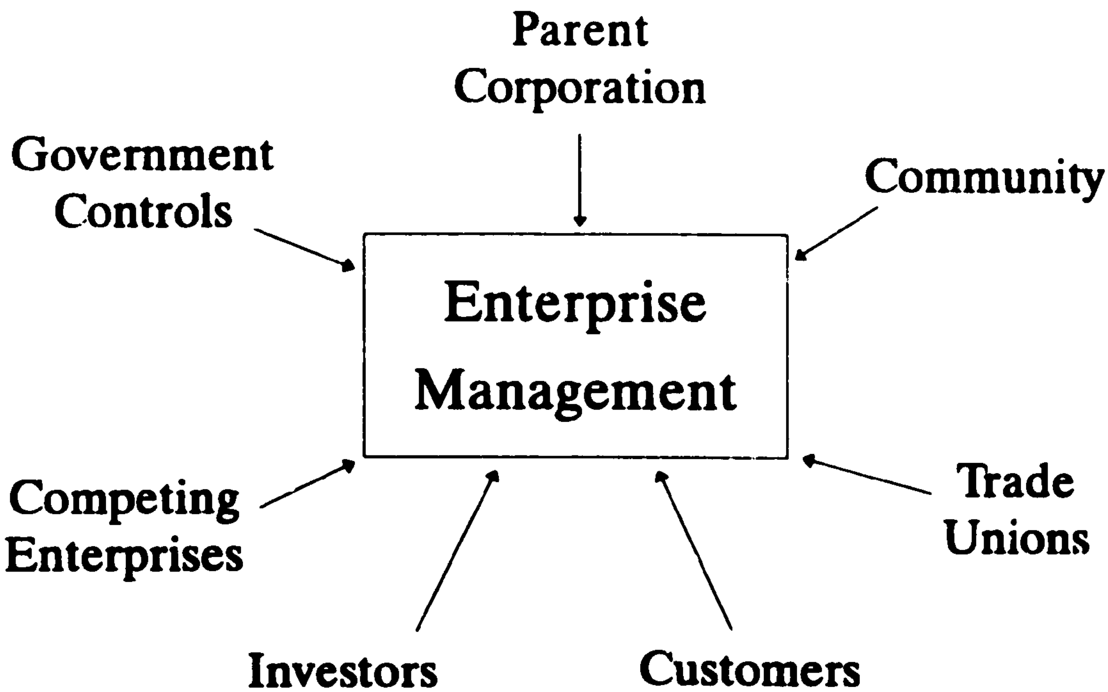
The Enterprise Perspective on EHS

In any economy—free market, mixed, or socialist—policies, programs, and practices at the enterprise level are the foundation of EHS impacts on workers and communities. In its day-to-day, month-to-month, and year-to-year decisions, enterprise managers play a decisive role in managing hazards, both acute and chronic. Managers are the key actors in determining how products are designed and what production materials are used. They are pivotal in selecting production technologies, maintaining safe working conditions, ensuring effective emission controls, and handling industrial wastes. The most thoughtfully conceived and aggressively enforced government regulations can only supplement, not substitute for, responsible corporate EHS management. As Central and Eastern European enterprises transition to free-market competition and shed the protective relationships with government ministries and guaranteed buyers, responsible EHS management will be difficult to achieve amidst the competition in European and global markets.

While clearly pivotal in ensuring responsible EHS standards, enterprise managers do not operate in a vacuum. Indeed, as the marketplace replaces the "command" economy, linkages with buyers, sellers, regulators, investors, and other actors will proliferate. New pressures and opportunities for enhanced EHS management will emerge as these linkages evolve.

Figure 1 depicts a number of these actors, each of whom brings a different set of expectations and pressures to the enterprise. First, for some Central and Eastern European enterprises, the transition to the marketplace will mean the arrival of a parent corporation, most likely headquartered in Germany, the United States, France, Britain or other Western nation. As in any

Figure 1: Enterprise Management Subject to Multiple Forces



familial relationship, corporate parents bring certain EHS "genes" rooted in the missions, policies, and programs of the company and developed over many years of operations. In many instances, the new corporate parents will be a global corporation seeking an early presence in the region, willing to wait five or more years before profitability is achieved at the enterprise, and prepared to move aggressively to reconstruct physical plant and product lines to fit a broader corporate growth strategy fashioned at headquarters. For the former enterprise, the norms, behaviors, and standards—that is, the EHS culture—are likely to differ widely from those historically found in former State enterprises. Cultural assimilation will not come easily.

Next are communities to which enterprises historically have been marginally accountable. The transition to the marketplace is likely to add complexity to enterprise-community relations which has been typically one of employee-employer relationship. Central and Eastern European enterprises can expect the role of communities to expand beyond suppliers of labor to one which includes a watchdog role in relation to a facility's EHS performance. This, of course, will not occur overnight, but as part of the gradual expansion of citizen expectations and enterprise accountability. Even in the United States, where enterprise-community relations are probably the most information-rich and contentious among the Western countries, nearly two decades elapsed before regulations allowed communities access to the information they needed to actively monitor facility operations.

Trade unions may emerge as a formidable force in strengthening EHS management in the region's enterprises, though at this juncture their viability, influence and priorities remain uncertain. The struggle to preserve jobs during economic restructuring will tend to deepen the perceived jobs-EHS dichotomy which persists today even in many Western trade union circles.

In Poland, Solidarity's leadership in forging political change throughout the 1980s sets Poland apart from its regional neighbors, though EHS has never been a top Solidarity priority. Continuation of employee councils in state-run Polish industries, still the dominant form of ownership, provides a vehicle for aggressive EHS demands on management if labor views such actions as a short-term priority. Incipient, independent (non-government) union activity in Czechoslovakia and Hungary offers an opportunity to advance workplace safety and health, though here too the pressure to retain jobs in the short term is sure to challenge labor's effectiveness in negotiating with management for improved workplace conditions.

Customers, the buyers of the intermediate and final goods, are a potential driver to enhanced EHS performance. The emergence of "green consumerism" in the West, manifested in corporate efforts to project a green image and market green products, reflects the growing sensitivity of buyers to corporate environmental responsibility. However, in Central and Eastern Europe, long deprived of both variety and quality in consumer goods, it is difficult to envision a powerful short-term role for green consumerism in promoting responsible EHS management. This is especially true if green products come at additional cost which, in highly inflationary times, will offset any potential inclination consumers might have for environmentally-friendly enterprises and products.

Investors may play a role in advancing EHS in the region's enterprises, though the effects are likely to materialize principally when foreign capital is involved. It is difficult to see how domestic privatization schemes will foster EHS, as in the cases of Czechoslovakia's and Russia's issuance of coupons redeemable as shares in privatizing enterprises. "Green" investment funds comprising environmentally-screened enterprises are unlikely to hold much appeal for either individual investors or the money managers who pool large quantities of coupons into Western-style mutual funds, such as those that have formed in Czechoslovakia.

On the international front, however, enterprises are feeling EHS pressures from the earliest stage of investor interest. Overall, foreign investment has been cautiously slow, though some notable acquisitions have occurred: General Electric purchase of the Tungsram light bulb company in Hungary; Unilever purchases of a Polish laundry detergent maker; and Volkswagen's purchase of Skoda car works in Czechoslovakia. Nevertheless, foreign investors remain wary of environmental liabilities associated with acquisition of land and buildings of the region's state enterprises. Along with the many other delays and difficulties in closing deals (e.g., Polish worker council approval of privatization deals and government approvals for foreign ownership of land), foreign investors generally are unwilling to absorb potentially exorbitant remediation costs mandated under current or future national laws and regulations. Such investor concern has given rise to a new service business in environmental assessment of properties prior to ownership transfer. Such assessments are now routine in the United States, and United States companies are active in developing such services in Central and Eastern Europe.

Competing enterprises may emerge as a force to accelerate EHS improvements in the region's enterprises, but this is likely to evolve slowly throughout the 1990s. The reason is simple: the green label on enterprises and their products, though fashionable and saleable in Western economies, is unlikely to hold much appeal in the East. Consumers living with high rates of inflation, depleted purchasing power, and tenuous employment conditions are unlikely to place much value on green consumerism. This is true especially when environmental friendliness comes at a higher price which further taxes the already strained consumer budgets. If enterprise competition is to work toward improved EHS, it is more likely to occur indirectly through rebuilding the region's industrial infrastructure into cleaner, more efficient and competitive modes of production. Because efficiency implies reduced wastes and reduced worker and community hazards, those enterprises able to shift to cleaner technologies also will become EHS leaders in the region.

Finally, government controls on EHS performance of enterprises undoubtedly will become more stringent over the course of the 1990s. The lack of accountability of enterprise managers to workers and communities under the former regimes will be replaced with EHS standards and practices which resemble those of Western, especially European Community, countries. This will occur for two principal reasons: (1) requirements imposed on countries such as Czechoslovakia, Hungary, and Poland that are seeking affiliation and ultimately full membership in the EC; and (2) steadily growing pressures on enterprises by citizen and environmental organizations for disclosure of EHS information, accompanied by access to the courts to achieve redress of grievances. How quickly these trends will evolve is unclear and highly variable across countries. Whatever the pace of change, it is clear that government's withdrawal from industry signals the gradual decoupling of the regulated from the regulator. This, together with the emergence of citizen/environmentalist political pressure, will create greater accountability, oversight, and incentives for enhanced EHS performance in the region's restructured enterprise.

Rights and Obligations

Privatization of industrial enterprises is not simply restructuring in an economic sense. It heralds a fundamental change in responsibility as well as rights. In shedding the protective cover of government ownership, productive assets — raw materials, capital, technology, and labor — can be bought and sold by private parties. The more parties that hold assets, the more efficient the free enterprise system functions. When such assets become concentrated in the hands of few owners, or when few consumers dominate purchasing in the marketplace, the preconditions for efficient free markets break down. In like fashion, when information on prices and quality of goods and services is deficient, or when goods or services are inappropriately priced or not priced at all, the preconditions for efficient markets are violated.

In Central and Eastern Europe, much time will be needed before markets begin to take on the features of Western-style markets, which themselves, of course, suffer from deep imperfections. Progress toward privatization is erratic, subject to countervailing conservative political pressures, and hindered by deep inertia of nearly a half century of central planning and price controls on state enterprises. Prices today are highly volatile, reflecting currency fluctuations, the breakdown of historical supplier-purchaser relations in manufacturing and wholesaling, and consumer uncertainty as to the day-to-day availability of basic goods. These conditions combine to make a highly fluid and unpredictable environment for the formation of new enterprises. At the same time, the opportunity for entrepreneurship has never been greater, and those enterprises that take root during the early stage of economic transition are in a position to reap rich rewards during the next 5 to 10 years.

The transition to free markets carries with it new responsibilities as well as new business opportunities. From an EHS perspective, the "responsible" corporation is one which acts as a steward to its workers, to communities, and to society as a whole while sustaining its own economic viability. In the same way sustainable development views economy and environment as inextricably linked, forward-looking corporations will view high levels of EHS performance as integral to their own long-term viability and competitiveness.

What does corporate stewardship mean at an operational level? Emerging private enterprises in Central and Eastern Europe are, or soon will be, entitled to land ownership—the right to extract resources, purchase property, and build factories. With this right of ownership comes the responsibility to minimize ecological disruption during extraction, to use materials efficiently, and to design and maintain safe workplaces.

Headquarters of Solidarity in Warsaw.

Private enterprise in market economies also has the right to accumulate, purchase, borrow, and invest capital—capital in the form of technology, equipment, and financial resources. However, as in the case of land stewardship, capital utilization has its obligations, namely the sustainable use of "natural capital" such as clean air, clean water, marine resources, and forest lands. This more expansive definition of capital is an emerging concern among multilateral donors and national governments seeking to redefine national accounts to incorporate the use and depletion of natural assets. This kind of thinking increasingly will reach enterprises such as lending institutions, permit-granting ministries, and nongovernmental organizations as they scrutinize proposed private investments for their compatibility with sustainable use of natural resources.

Labor relations is another dimension of management which will undergo fundamental changes in the transition to market economies. Here, too, both rights and obligations will shift from the public to the private domain. As the state sector diminishes, enterprise managers (within the boundaries of changing labor-management agreements and labor laws) will assume responsibility for hiring, dismissal, and wage-setting. At the same time, management also will assume responsibilities for health, safety, job security, fair opportunity for advancement, training, and good-faith bargaining. The responsible corporation will see these as opportunities rather than burdens, a time to engineer into factory operations safe technologies to set the stage for future competitiveness within and outside Central and Eastern Europe. The payoffs to such foresight promise to be rich and varied: minimal worker absenteeism due to injury and illness, higher levels of productivity and worker satisfaction, the ability to attract and retain a capable workforce, and avoidance of future production disruptions owing to enactment of new EHS standards by the European Community.

Finally, fundamental changes in enterprise-customer relations will occur with privatization. In a command economy with centralized decision-making of the type, quantity, and timing of goods, enterprise managers devoted little attention to issues of consumer preferences, product quality, and product safety. Determination of supply was a central function essentially detached from consumer demand. With privatization, however, supply-demand relations are rapidly changing to the Western-style model of consumer-driven economics. New enterprises will be free to produce according to their assessment of marketplace conditions, and to freely negotiate the terms and conditions of their produce sales. These are the rights of the enterprise.

As in earlier cases, obligations accompany such rights. In the context of consumerism, enterprise obligations mean producing safe products which perform the function they are intended to serve, and fully disclosing any EHS hazards associated with the manufacture, use, and disposal of the product. Disclosure of use hazards is a well-established norm in Western countries through product labeling. Disclosure of manufacturing and disposal hazards is an emerging trend represented in the large number of "eco-labeling" schemes in practice or under study in many countries of the European Community. Enterprises in Central and Eastern Europe can expect to face increasingly rigorous product labeling standards as well as international, and eventually domestic, demand for green products.

The Lifecycle Framework for Enterprise Management

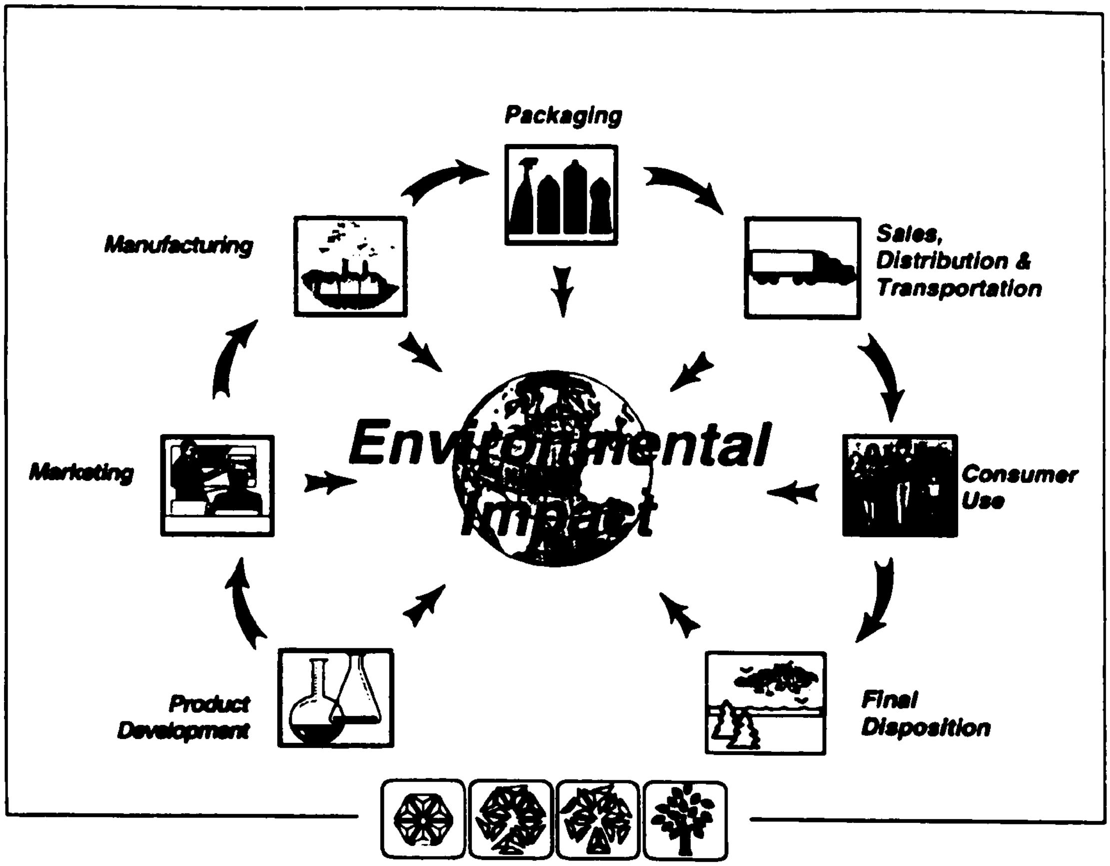
Responding effectively to communities, trade unions, regulators and other actors with a stake in EHS, and recognizing the rights and obligations of enterprises in a market economy, will require a major shift in how enterprises conduct their business. One approach to bringing these multiple forces into a coherent management strategy is to think about production and products from a lifecycle perspective. Lifecycle analysis (LCA) has undergone a rebirth in recent years in many Western countries after an initial appearance in the late 1960s and early 1970s in response to the Western energy crisis. At that time, LCA was developed as a policy tool for evaluating total energy requirements of alternative energy supply systems taking into account extraction, transport, and use efficiency factors.

More recently, LCA has resurfaced as a tool for assessing "cradle-to-grave" ecological and human health impacts of different processes and products. In this form, it serves as a tool to assist policy decisions about where to create incentives and mandates for waste reduction, as a basis for designing "eco-labeling" schemes, and as a framework for companies to assess how to better manage materials throughout their production processes. In this second role, LCA allows the enterprise to see its operations within a system's framework wherein the EHS impacts may be identified, tracked, and targeted for improvement at each stage of the product lifecycle. This lifecycle begins with materials extraction, and moves on to material processing, manufacturing, product use, disposal. Each step introduces environmental and safety hazards potentially affecting workers, communities and product consumers. Companies that think strategically will recognize policy trends toward holding producers responsible for all environmental costs, whether they occur at the beginning, middle, or end of the product lifecycle. The burgeoning number of pollution taxes, penalties, and regulations is strong reason for firms to think in a precautionary, or preventative, mode to ensure future competitiveness.

Figure 2 presents schematic view of LCA from the enterprise perspective. Beginning with research and development (R&D) and design, and ending with ultimate fate (or product disposal), each phase in the product's life creates some level of environmental impact. In this scheme, product packaging in the form of glass, paper, plastic, metal or other material is viewed as integral to the product itself and acts as an independent contributor to the environmental burdens over a product's lifecycle. A full accounting of these impacts, and efforts to reduce impacts, requires involvement of several units of the firm. Depending upon the size and product line, these may include: R&D, marketing and sales, engineering, production, materials management, purchasing/procurement, quality assurance, maintenance, EHS, and finance and accounting. The extent to which LCA is effectively deployed depends largely on the commitment to, and coordination within, an enterprise's strategic planning process.

Conclusions: Amidst economic hardship and restructuring in Central and Eastern Europe, enterprise managers will be hard pressed to attend to seemingly secondary issues of EHS management. Though these pressures are real and urgent, so too are the opportunities for long-term strategic advantage. As privatization proceeds and new forms of ownership take hold, enterprises that survive the next five years will be subject to changes rarely witnessed in

FIGURE 2: LIFECYCLE ANALYSIS FROM THE ENTERPRISE PERSPECTIVE



industrial societies. These changes will occur during a period of increasingly global markets and free trade. To compete successfully will require gradual conformity with international EHS standards, awareness of emerging green market opportunities, and recognition that clean production techniques are compatible with profitability.

Enterprise managers in Central and Eastern Europe who dismiss EHS as a secondary matter do so at substantial risk to the long-term viability of their enterprises. Indeed, the Western experience demonstrates that firms with such a commitment invariably are those whose workplaces, products, and profitability rank among the industry leaders. Though this message will be difficult to communicate and act upon during the difficult economic transition in the region, it is a message well worth heeding.

CHALLENGES AND OPPORTUNITIES IN PROTECTING THE ENVIRONMENT AND HEALTH IN A MARKET ECONOMY: COMMUNITY PERSPECTIVES AND ROLES

Monica M. Becker
Tellus Institute
Boston, Massachusetts, USA

Generally, community can be defined broadly as a group of people who are linked by a common interest, problem, or policy. For example, the global community shares a common interest in protecting the ozone layer and the common problem of ozone depletion. There are economic communities, such as the European Community, and national communities that have a common system of law. While each of these communities has a role to play in environmental and public health protection, I will focus this paper on a smaller community, in geographic terms—namely, the community surrounding a point source of pollution, such as a factory or waste disposal facility. This type of community consists of people in an environment that is directly affected by the practices of the facility.

The Current United States Environmental Protection Strategy: Generally, in the current United States environmental protection strategy, federal environmental agencies, such as the United States Environmental Protection Agency (EPA), and state or local environmental agencies set specific pollution limits for categories of industrial and non-industrial dischargers. These limits are based on risk or risk assessments and available pollution control technology. The agencies monitor compliance with these limits through permits and reporting requirements. Permits are essentially licenses held by a plant that allow the plant to emit pollutants up to a certain level. Typically, permits require the plant to report actual emissions on a monthly or yearly basis to allow the agency to compare performance to the limits established in the permit. If companies are out of compliance, the agencies enforce the limits through fines.

The Community Perspective on the Implementation of the Strategy: The growing community view of this environmental protection strategy can be characterized by a lack of community trust or confidence in environmental agencies—in both their judgment and ability to truly protect human health and the environment. This distrust is based on a belief that emissions limits are not adequate because an insufficient number of pollutants are regulated or because the limits are not strict enough. Communities often believe that limits are not properly enforced. There is a growing perception that agencies are more responsive to the demands of industry than to the communities that they are responsible to protect.

These views are formed either through empirical evidence (through observation, for example, of an elevated cancer rate in a neighborhood or the absence of fish in a stream), from information on health or environmental hazards obtained via the media, or through direct experience in a public process involving a state or federal environmental agency.

Community Groups: Two broad categories of groups in the United States represent communities' interests at the local level. One is a local group that is organized around a specific polluting facility. Its common interest is in protecting human health and the health of the local environment. The second type is a state or a national organization—a larger organization—working on the local level to protect the health of a community. with respect to a particular plant.

Many environmental and public health laws establish a mechanism for citizen or community group involvement in the setting of standards, and for the development of environmental impact reviews of large construction projects. Environmental laws provide for public hearings, where citizens can voice their opposition to a regulation or standard. Not surprisingly, in some cases the agency modifies its strategy according to public opinion; in some cases, it does not. Many environmental laws contain built-in rights for citizens to use the legal system to either force agencies to enforce the law or improve the law, or to actually use the legal system to force industries to comply with laws. Citizens have created a tradition of citizen and community involvement in environmental and public health protection.

The Role of Information in Community Involvement: The nature of community involvement in health and environmental protection is changing, as characterized by a shift toward a greater and more direct role by community groups in protecting their health and environment, and a shift away from a reliance on state or federal agencies to represent their interests. This change stems largely from the increased availability of information on the types, quantities, and impacts of pollutants that are being discharged. Information has empowered communities by: (a) increasing their understanding of the nature and magnitude of risks posed by a local facility, (b) helping them to evaluate and participate in regulatory programs designed to reduce risk to the community, and develop their own strategies for pressuring agencies or industries, or (c) collaborating with them toward risk reduction.

Many sources and types of information are available to community groups in the United States; I will highlight a few. The Toxics Release Inventory, established by the EPA in 1987, is a database of toxic chemical releases, from specific plants, to air, water, and land. Companies are required to report this information once a year. Several national environmental organizations make this information more accessible to community groups through electronic databases and reports. If I, for example, live near a chemical plant, I can use a public computer database to find out exactly what kinds of toxic chemicals are being released into my environment.

With emissions data in hand, a group can gather information on the health effects of these substances. There are many ways to obtain health effects data. TOXNET, for example, is a computer database developed and maintained by the National Library of Medicine of the National Institutes of Health in the United States. It has many forms of toxicological data and is designed to be used easily to find information on the specific impacts of many substances.

Communities can obtain information on the specific emissions standards that facilities are required to meet. This information is becoming more accessible through computer databases, such as TOXNET, that contain environmental release and exposure standards. The emissions, health effects, and standards information for a particular facility forms a profile of the risks posed as well as the environmental performance of a facility.

Community Action: Many community organizations are directly pressuring government agencies and politicians to increase the list of regulated pollutants, tighten regulatory standards, and improve enforcement of existing regulations. These groups are also beginning to pressure industries to move beyond what is required by existing regulations—largely because they do not feel that the EPA, for example, is setting appropriate limits. In some cases, they are doing so by pressuring companies to make fundamental changes so that they manufacture their products with less toxic material from the start of the process.

Community groups have learned that the mass media is an effective political tool to pressure industries indirectly. Companies in the United States are extremely sensitive to bad publicity, and an effective means of "persuading" a company to meet demands is to publicize poor environmental performance in a newspaper or magazine, or on radio or television.

A CASE STUDY OF DIRECT COMMUNITY INVOLVEMENT IN HEALTH AND ENVIRONMENTAL PROTECTION

A petroleum refinery was a heavy polluter of San Francisco Bay in the 1980s. In 1986, the plant discharged 35 percent of total emissions of chromium and 50 percent of total emissions of nickel into the Bay. Federal emissions standards were very weak at the time and these emissions were allowable. An organization called Citizens for a Better Environment used its legal rights in court to pressure the EPA to reduce the effluent limitations in the company's permit. It claimed that the limits were not strict enough according to the mandate set out in the governing law. The group won its legal case and EPA changed the company's permit. The group developed an agreement directly with the company, called a "good neighbor agreement." It included a promise by the plant to reduce its discharges of chromium and nickel through process changes, rather than pollution control (which typically just shifts the pollutants from air or water to land). As a result of this agreement and the modifications to its permit, the company, by 1988, reduced chromium emissions by 67 percent and nickel emissions by 86 percent.

As a footnote to this case, the EPA set the company's allowable emissions at about 7,000 lbs. per year of chromium, which was based on the best technology available to control these emissions. During this process, the company was able to reduce its emissions of chromium to 600 lbs. per year. We can see that the technology-based standard poorly reflected the technological ability of this company to reduce its discharges.

In summary, community groups in the United States, which are not confident in the ability of public agencies to protect their health and environment, are increasingly taking a more direct role in environmental and health protection. Information, such as data on emissions and their health effects, enables communities to understand the type and magnitude of local hazards and to engage more effectively in decision-making for risk reduction.

A WORKER'S HEALTH PERSPECTIVE ON THE EFFECTS OF A MARKET ECONOMY

Beth Rosenberg
Department of Work Environment
University of Massachusetts Lowell
Lowell, Massachusetts, USA

In the United States, only 17 percent of workers are unionized. This low percentage of organized workers has its consequences. Last year, 25 workers were burned to death in a plant that made fried chicken. The plant had huge vats of very hot oil and not enough fire extinguishers. The back doors were locked—a violation of the safety code. The plant had not been inspected for 11 years. Two years ago, women in another chicken processing plant were interviewed. They reported that they had to ask permission to go to the bathroom. And when they were refused permission, they urinated on the floor. With all the chicken blood on the floor, what difference would human urine make? And besides, it saved time.

I live in a country where 20 years ago a pesticide manufacturer found out that one of its products caused testicular atrophy in rats, but nevertheless continued to manufacture the pesticide. Fifteen years later, when it was discovered that the pesticide was causing the men who made and packaged it to become sterile, a company spokesman said, "We didn't know that it caused sterility in the rats. And besides, the testicular atrophy occurred in rats. We didn't know what it would cause in men."

These are not random unfortunate events. These are the natural consequences of a system of production in which the health and dignity of workers are a lower priority than profit. There is a widespread belief that the market is efficient, that it takes care of things. As you can see from these examples, this belief is a myth.

The market economy in the United States assigns values in twisted ways. A market economist looks at a forest and assesses its value as the price of the wood when it is sold. The loss of the forest, and not having it next year and the year after that, does not enter into the accounting. Until recently, polluting the air and the water also did not have a cost; it was free. But now, companies must pay a fee to dispose of their hazardous wastes. There is some financial motivation to control pollution. However, there seems to be little financial incentive to make workplaces safe because each year in the United States an estimated 100,000 people die from work-related hazards and over 6,000,000 are injured.

The workers' compensation system demonstrates that workers' bodies are not worth very much. If a worker is totally and permanently disabled from an injury at work, he or she gets two-thirds of his or her average weekly wage for the rest of life, and also a lump sum for body function lost. In Massachusetts, where the average wage is $24,000, a worker who loses eyesight receives $49,000; hearing, almost $40,000; the ability to comprehend language, $16,000; sense of taste,

$4,400; an arm, $22,000; a leg, $20,000; and sexual function, $5,000. But if I tripped and fell in a restaurant and lost the use of an arm, I could file a legal suit against the restaurant and possibly make 20 times more than a worker similarly injured on the job. A major limitation of the workers' compensation system is that, unlike the legal tort system, a person's potential earning power and pain and suffering are not considered.

A business textbook describes how managers are taught to deal with the problem of an unsafe workplace: "In making decisions about their workplaces, managers have two choices: they can remedy health and safety problems, or they can provide risk compensation to workers. If reducing risks is less costly than the additional compensation, then working conditions will be improved. However, if the marginal cost of workers' compensation is less than the marginal cost of safety improvements, then the firm will choose the compensation alternative. This outcome represents an efficient allocation of resources in that the firm minimizes its total costs." Notice the text did not say, "Do what is right"; it said "Do what is cheaper."

So what can we do to constrain the brutalizing effect of the market? In the United States, workers cannot rely on the courts; the courts are arbitrary and, under workers' compensation laws, an employee is not allowed to sue an employer. The public is generally indifferent to these issues. What we need is regulation to establish a minimum standard of how an employer can treat a worker. We need strong enforcement, for even wonderful humane regulations are worthless without it. And what we most need to do is internalize the cost of workplace injuries and diseases. In order for companies to be interested in reducing hazards, we must make it very expensive for companies to hurt people. The workers' compensation system does not accomplish this because it is an insurance system that is designed to spread costs over all employers. It does not provide strong incentives to improve the workplace.

No improvements will occur unless power relations change. In a democracy, everyone has a voice, but some voices are louder than others; at this time in the United States, labor is whispering. We need to strengthen labor through labor education and training about health and safety. We mainly need to build alliances among labor, environmental, and community organizations. We also need to build alliances among public health professionals and labor activists; such alliances helped to enact right-to-know laws passed in the United States—laws that ensure that workers have a right to know about hazardous chemicals that they work with.

In the United States, England, and some other countries, coal miners formerly took small birds, canaries, down to the mines. If a canary died in a mine, it signified there was a dangerous level of carbon monoxide in the air—a warning that it was time to leave. In the United States, there is not much sympathy or empathy for workers, so we need everybody to understand that workers are the canaries for the rest of us. If we lower their exposure to toxic substances by using cleaner methods of production and having stronger regulation, then our exposure is reduced. It is therefore in everyone's interest to make the workplace cleaner and safer. Market economies differ. For example, in Sweden and Germany there is more of a balance in power between labor and management than in the United States, and labor has more of a voice than in our country.

MEDICOLEGAL ISSUES IN OCCUPATIONAL AND ENVIRONMENTAL HEALTH IN A MARKET ECONOMY

Daniel Thau Teitelbaum
Medical Toxicology Partnership
Denver, Colorado, USA

The concept of "market economy" has been mentioned repeatedly during this symposium, but no satisfactory definition of a market economy has been offered, except by Dr. White. Perhaps the definition has been omitted by our European colleagues because the formal presentations on risk assessment, risk control, and environmental and occupational health policy have been made by scientists and policy-makers whose work has been done in institutions of government or in institutions supported by government. In such settings, one may not be forced to face the reality of a market economy and to define it. Our discussions have taken place in an intellectual milieu that is supportive of a market economy, but which has little or no experience in the tension and interaction between competing interests that maintain and fuel the free market system.

Only a few presentations have been made by private citizens, entrepreneurs, "special interest groups", or nongovernmental organizations (NGOs). These groups or persons may best understand the realities—though not the theory—of a market economy. The problems of health and environment, both within and outside the workplace, are often better understood by ordinary citizens who live with them on a daily basis than by government agency staff members who have been appointed to advise and protect these citizens. This reality is manifest in countries that have market economies, where it has raised judicial, legislative, social, and economic problems for citizens.

In my experience, the solutions that citizens or workers propose or demand to occupational and environmental health problems that affect their lives are often more direct, reasonable, and practical than the formal institutional solutions that are sometimes tried. Unfortunately, they are often also more expensive than other solutions that might also work, but these other solutions cannot be understood by persons who are not technically trained. Technicians may study, oppose, and obstruct these solutions and not reach any satisfactory conclusions to the problems for a long time.

It is a paradox that the path to a market economy demands the theoretical support and financial backing of governments to which the market economy is unfamiliar or anathema. Environmental and occupational health in a market economy cannot evolve from market forces alone. The paradox is not limited to the emerging economies of Central and Eastern Europe. It is expressed in Western Europe and in the United States. Government guidance may lead to delay in resolution of environmental and occupational health problems because the solutions are not concordant with institutional economic goals, although they may be entirely consistent with the needs, goals, and desires of the people governed.

In my experience, when workers or affected populations wait for delayed government solutions to problems in environmental and occupational health, they actually inhibit progress to resolve recognized health problems. Such a delay in problem-solving may lead to increased morbidity and mortality in workers or other citizens. It may also lead to further degradation of environmental resources that are essential to the emergence of a market economy of the affected region. Patience in these situations is not necessarily a virtue.

For example, an interplay of market forces between workers and managers may catalyze the development of solutions to some dilemmas that are in conflict wi'' government planning. Government may actually support programs that produce delays in resolution of environmental and occupational health problems and cause frustration, anger, and counterproductive outcomes, causing confrontation between the affected and the effectors. The confrontations generate demands for action, equity, and justice, not previously voiced in a controlled society. Usually, environmental and occupational health demands are couched in economic terms and can be resolved if money is available for their solution. Strikes, job actions, and resistance and boycotts by organized labor and others may lead to negotiation of demands for improvement in occupational health. Outside the workplace, Greens in Western and Eastern Europe and environmentally concerned groups in the United States and elsewhere have produced a popular groundswell for change and environmental improvement. However, unless an economic basis for change exists, little progress actually occurs. Sometimes the demand for change in environmental status takes a violent form. We have seen the emergence of small action-oriented "environmental commando" groups in the United States that may presage a more action-oriented environmental movement worldwide in the future.

In the United States, interaction between the affected and effectors has led to a high level of tension. Although it is tempting to classify the effectors as "business or industry" and the affected as workers and members of the general population, this simplistic categorization of the extremes of the problem is not appropriate. Consumers who demand goods, workers who demand jobs, business people who demand profits, government officials who demand support, insurance company representatives who seek profit, and others enter continuously into the complex balance that sustains our market economy. The delicate balance of rights and obligations constantly shifts and swings. The market economy of our democratic society has produced a code of environmental and occupational health laws. These laws have led to regulations, which have led to litigation in court of some of the most complex and difficult environmental and occupational health problems.

Legislative, regulatory, and judicial management of environmental and occupational health directly affects my day-to-day clinical and academic work in occupational toxicology. Laws and regulations have partially empowered workers in quest of a safe and healthful environment. They have partially empowered private citizens in quest of protection from inflicted environmental degradation and adverse health effects. But they have degraded the capacity of the health care system and the environmental quality industry to respond to the problems by smothering them in layers of regulation and judicial action. It has also greatly increased the cost of action by adding millions of dollars of legal bills to all the other costs.

Government participation in prevention, identification, and correction and elimination of environmental and occupational health hazards has often slowed the process of correction of these hazards. It has interfered with direct interaction between the concerned parties and has massively increased the costs of action in environmental and occupational health. While it has resulted in some significant accomplishments in environmental and occupational health, there is little evidence that the current regulatory mechanism has produced a material improvement in occupational health and safety or in environmental quality for the average American worker or citizen.

The current American legislative, regulatory, and judicial structure for environmental and occupational health has produced an economically viable service industry dedicated to the identification, elimination, or modification of environmental and occupational health problems. This industry employs thousands of highly-trained professionals in medicine, science, engineering, economics, risk assessment, waste technology, law, and many other disciplines. A huge amount of money moves through this "business," although little "sell-able" product emerges and no significant growth of the economic base results. There is little to show for all of the money spent. There is almost no evidence of improvement in environmental and occupational health, or of improvement in environmental quality for the average American worker or citizen. The current environmental and occupational health structure delays interaction among the parties whose conflicting interests are involved. Thus, negotiation possibilities are reduced or eliminated. It insulates workers from managers and insurance company officials from their insured parties. It injects government bureaucracies into every dispute that arises. It forces affected communities to go through laborious and very expensive legal steps to bring their concerns to light. It has not brought solutions to medical and legal problems in this area, and has produced massive costs to our market economy.

Much of my work is now accomplished in this structure, in which the executive and legislative branches of our government have slowly and reluctantly assumed responsibility for worker health and safety and for environmental protection. But under our system, the validity, constitutionality, and application of environmental and occupational laws and regulations must finally be tested in our civil courts before lay judges and juries. The capacity of these judges and juries to decide the issues is often astonishing, but the process is long and slow and excruciatingly expensive. If the 61,000 asbestos cases currently pending in the federal courts in the United States actually go through all these steps, the court system will do nothing else for years!

My evaluation of individual injuries and illness that develop in the workplace and of the environmental impact of industrial practices, both past and present, occurs with the knowledge that most or all of the information that I develop will inevitably be heard in court. I view every patient record I create and every environmental issue that I investigate and document as a piece of evidence that will eventually be scrutinized under oath by lawyers whose incentives to resolve the issues are heavily influenced by the hourly wages or contingent fees that they receive and the parties whom they represent. In my practice, if I treat a worker for lead poisoning or detect an excess rate of leukemia in a population near an oil refinery, I inevitably trigger a complex and expensive legal exercise that seeks to compensate the victim for the injury, to compel the effector to desist, and to mollify the population that is affected.

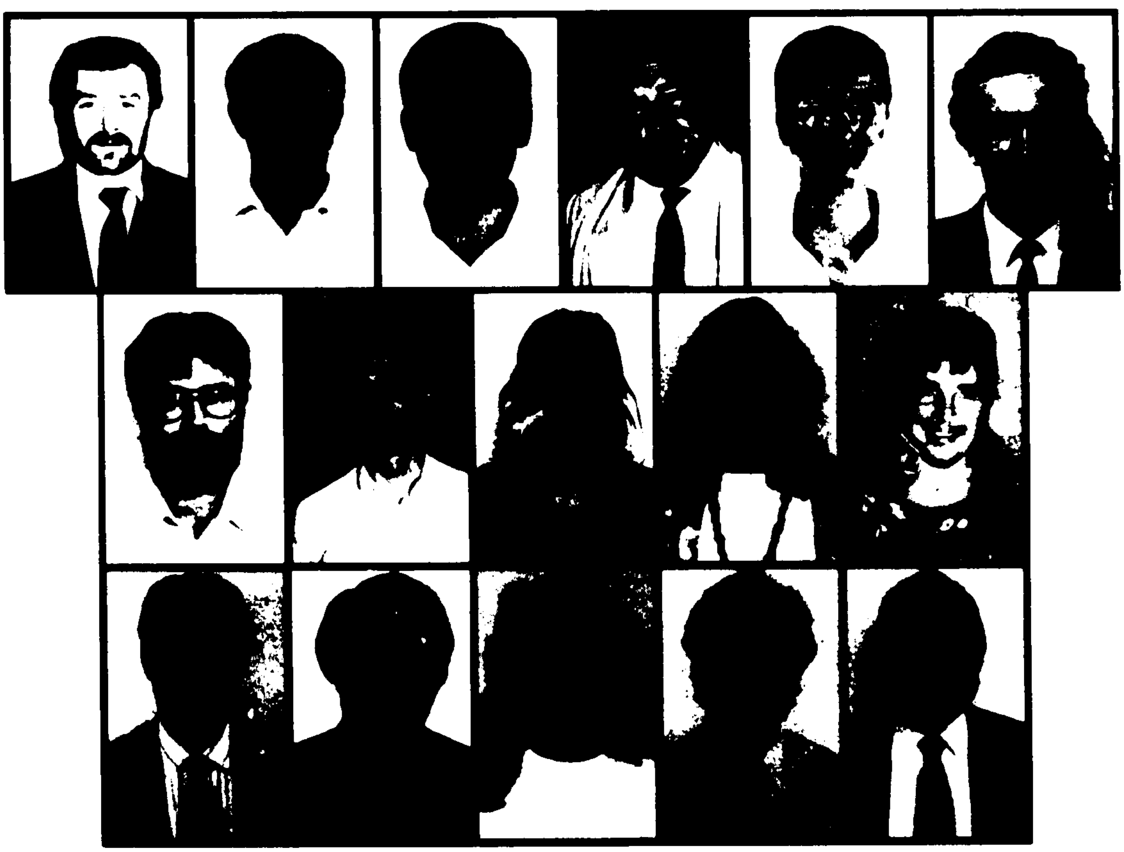
In our market economy, the resolution process is significantly impacted by the transactional costs of solving the problems, including the costs of medical and environmental evaluation, and the regulatory technical evaluation of solutions and judicial structure within which the solution must be found. Remarkably, some justice usually emerges from this byzantine process, but at costs that are intolerable—even in our affluent society. The system of resolution of environmental and occupational health problems through litigation in civil courts that has been adopted in the United States cannot reasonably be exported to other societies. Although a satisfactory resolution of conflicts between poisoner and poisoned, between polluter and polluted, is often achieved in our system, the slow nature of progress, the enormous expense of its apparatus, and the drain that it places on our "productive" economy would not be tolerable in most other countries. The personnel and technical costs are too high. Incidentally, our system could probably absorb and employ many of Central and Eastern Europe's well-trained environmental scientists who are now unemployed or marginally employed.

In the past 25 years, I have become convinced that a system of conflict resolution of scientific issues in environmental and occupational health—other than one in the civil courts—will have to be developed if further progress in environmental and occupational health is to be achieved. While it is satisfying to each side to win or lose a case that involves these important issues, the process of resolution saps the economy of dollars, delays the resolution of pressing problems, encourages further governmental regulation, and fails to resolve conflicts between the effectors and the affected.

I believe that the solution to conflict resolution in this field in the United States and elsewhere demands the development of systems in which those affected by environmental and occupational hazards and those who produce these hazards are brought together to negotiate reasonable and practical solutions to the problems. Such a negotiated settlement, actualized with the assistance of all of the modern technology of science, economics, and sociology and given the force of law, may be a viable method to resolve what seem to be insoluble environmental and occupational medicolegal problems.

PART TWO: MARKET ECONOMIES AND DEMOCRATIC POLITICAL SYSTEMS: CHALLENGES AND OPPORTUNITIES

SECTION FIVE: PUBLIC PARTICIPATION: DEMOCRACY IN ACTION



Top row: Piotr Glinski, Cezary Korczak, Jan Sobótka, Jerzy Karski, Maja Maštrović, and Ferenc Bokros.
Middle row: Ondrej Velek, Karoly Fulop, Judith Perrolle, Barbara Felitti, and Jane Riggan
Bottom row: Charles Weinstein, Jim Tramel, Eve Spangler, John Wooding, and Charles Levenstein.

THE ENVIRONMENTAL MOVEMENT IN POLAND

Piotr Glinski
Service Office for Environmental Movements
and Polish Academy of Sciences
Warsaw, Poland

During the communist era, there were no truly independent environmental organizations in Poland. A few "official" conservation associations existed within the system and behaved according to its rules. They were completely controlled politically and conformed to a role in the system as set by the authorities. They were organized only to support the authorities in nature protection, and were not in a position to influence environmental policy. The political transformation of 1989 brought new possibilities for citizen influence on environmental policy, new participation rights, and new prospects for cooperation between NGOs and the government.

Historic Development: In the short history of the environmental movement in Poland, we can distinguish two main stages of development. Each stage refers to different social-political circumstances and to different types of environmental organizations. The first stage started approximately in 1980 during the time of the Solidarity movement. The second began with the political changes of 1989.

The first stage is characteristic of the political struggle against communism. It was a time of revolt, riots, and protests. During this stage, environmental groups expressed themselves through symbolic strategies, referring often to emotion and not to rational options and solutions. The most characteristic social actors at this time were spontaneous grassroots organizations and groups, often established because of local environmental protests. This was the time of the first attempts to put pressure on authorities from below. Characteristic of this time was a lack of negotiation mechanisms, lack of cooperation, limited flow of information, difficult public access to information, and lack of "know-how" and expertise. Many of the grassroots organizations—especially the youth environment groups—derived substantially from counter-culture traditions. These traditions were largely responsible for the movement's spontaneous and symbolic activity and low level of formal structure.

The second stage of development of the environmental movement, which we have only recently entered, is and will be a stage of rational strategies. It is characterized by a higher level of coordination of environmental activities, and skilled and educated professional staff with a high level of practical ability for solving problems. The members are learning the fundamentals of fund raising, management, project design, legal regulation, institutional cooperation, and dealing with the mass media.

In sum, in 1989, there was a developed environmental movement in Poland. It included over a hundred organizations and pro-ecological groups, about 80 organizations and groups concerned with ecological and other problems, and several ecological foundations. The main feature of this movement was (and still is) the differentiated character of its participants: the movement includes various youth circles, religious groups, expert and professional groups, regional and local organizations, and other groups. However, there were only a few groups of farmers, and workers participated only rarely. Individual ecological groups differed in their degree of institutionalization, legality, intensity of claims, involvement in social conflicts, engagement in political activity, and/or search for alternative cultures. On the other hand, they were united in their renunciation of any form of violence. It should be stressed that members of the movement were still subject to persecution by communists until mid-1989.

In 1989, major political, social, and economic change began in Poland. Possibilities arose for free participation in the newly established political structures and institutions. But only a part of environmental movement was engaged directly in the process of reforms. A few participants in this movement became members of Parliament or took governmental positions. Still, fewer of them remained active in the environmental field. In general, the environmental movement firmly refused to get involved with the new official political structures. A great majority of the youth environmental circles were indifferent to the political changes of 1989.

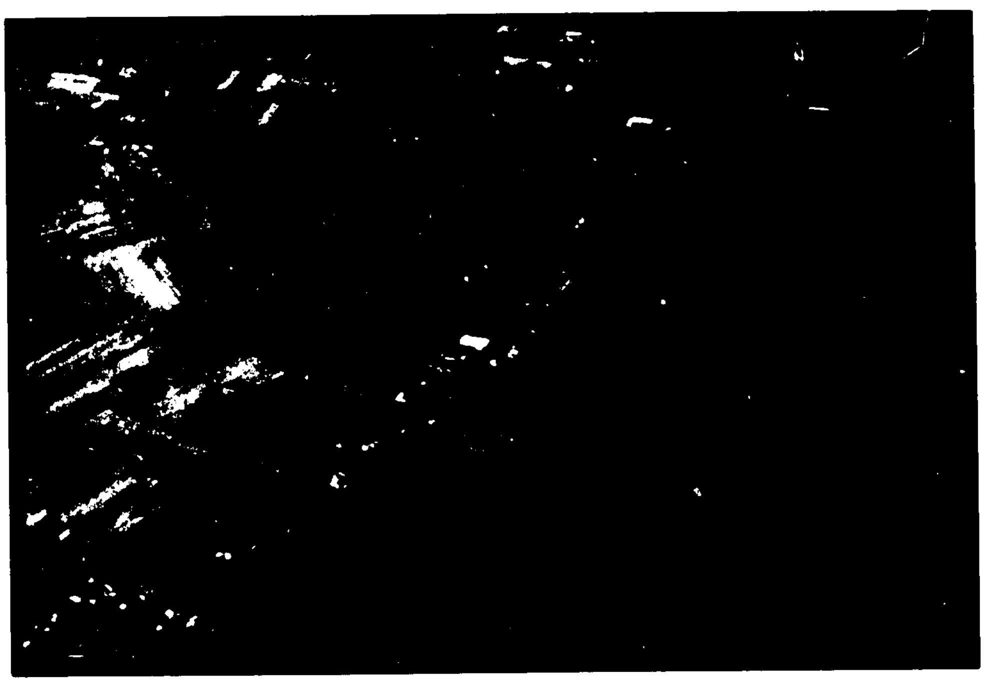
The leaders and the activists of the environmental movement are highly suspicious of the world of political institutions. Politics is usually perceived by them as a field of immoral and hypocritical behavior. Such an attitude has stemmed from the preceding political system and has been automatically carried over to the stage of systemic changes.

The rejection of the current political structure was also caused by the value-oriented life attitudes of the environmental activists. The environmental organizations were much more organized around their values than typical social interests. So, the participants of the movement perceived their attachment to the alternative values in contradiction to the political activity and institutionalization.

Another reason of the refusal of political participation is connected to the dominant forms of the environmental movement's activity during the 1980s. Most of these activities were of a defensive and passive character. Since the involvement in political cooperation requires more positive and creative forms of action, the leaders and participants of the environmental movement were not prepared to accept such a challenge. It would have required very deep changes in their mentality and ways of action. Most of the leaders lacked both the skill and the predisposition to fulfill these demands. They were accustomed to the old methods and strongly rejected the need of any changes in their activity, despite the new opportunities offered by the process of political transformation.

On the other hand, the new political establishment has played an important role in the environmental movement's reluctance to become involved with politics. During the time of underground opposition, the Solidarity leaders were not interested in ecological problems. Environmental issues were only used by the opposition for the purpose of political struggle against communist rule. This purely functional attitude towards the environmental movement did not change when Solidarity came to power. The movement was perceived by the new establishment as a group of very little importance. The formal relationships between the movement and the authorities were very limited. There were no rules of any kind of dialogue on the urgent environmental conflicts. The new government employed the old methods (although not so drastically). The police was sent out against the environmental protesters in Zarnowiec (nuclear power station) and Czorsztyn (dam). In the period of numerous social protests of various groups and lobbies (many of them illegal), radical repression was usually undertaken only against environmentalists. In the case of the Czorsztyn dam, a special law was imposed by the authorities, resulting in 134 cases in court. The social movement, oriented towards values—not an interest group—was treated by authorities as the weakest and least important opponent. Needless to say, such an attitude can result in a considerable radicalization of the youth environmental movement (such as soft ecological terrorism or monkey wrenching).

Nevertheless, the experiences from the last two large ecological campaigns, the anti-nuclear protests and the struggle against the Czorsztyn dam, led some of the environmental groups to the conclusion that the new forms of activity are needed. In the case of the Czorsztyn dam protest, one group of the activists decided to change the strategy and to supplement demonstrations and road blockades with more rational and moderate actions, such as: direct dialogue with authorities, seeking relationships with the ministry of environmental protection and parliamentary commissions to influence the decision-making process, building up a broad coalition of various environmental NGOs to coordinate their activity against the dam, and preparing an independent scientific report on the dam issue. The implementation of these methods, strongly rejected by the radical wing of the movement, caused a severe conflict and splits inside the movement.



Aerial view of countryside near Warsaw.

The "moderate wing" of movement entered the world of the political institutions and began to seek a more organized, coherent system of strategic activity. It joined the second stage of the environmental movement development—building effective, modern NGOs. Although it approached politics and even declared their intentions to set up some political structures, the only new political initiative was the institution in the fall of 1991 of the new ecological party, the Agreement for the Alternative Energies. It is the first Polish environmental party, still in its infancy, to stem from the ecological movement. Nevertheless, we can say that the need to improve the efficiency of movement activity forced a considerable part of the movement to get into closer contact with the system of political institutions (the "trap" of political participation).

Also, the forms and fields of activity had to be broadened. Thus, some groups decided to focus on improving the information network inside the NGO community and on radical improvement of cooperative capabilities for NGO activities. To meet these aims, the Service Office for Environmental Movements (SOEM) was established in Warsaw in 1991. But, generally speaking, the environmental movement is still organizationally very weak and lacks funds, experienced staff, coordination of activities, access to information, and conscious strategies.

Only a few NGOs, like the League of Nature Protection and the Federation of Consumers, and a few foundations have their own sources of funds. Some others, like the Polish Ecological Club, the Institute for Sustainable Development, and SOEM, accept support from abroad. Financial assistance should be accompanied by organizational assistance. More funds should be allocated towards the creation of financial independence for these organizations, such as by training their members in fund-raising.

As far as lack of experienced staff is concerned, there are very few NGO members who are trained in economic or legal matters. Because of the specific character of these disciplines in Poland, direct foreign assistance is not of great value; there is a need to educate our own specialists. There is a lack of administrative managers and skilled office technicians who are able to run NGO offices. The ordinary activists are not efficient at undertaking business activities. There is also a lack of experts in the newest fields of environmental technologies, like recycling, sampling and analysis techniques, alternative energy, modelling, and site assessment.

The Political, Social and Cultural Framework: The basic problems and difficulties for the activities undertaken by Polish NGOs stem from the cultural and socioeconomic conditions. Life in Poland is currently very difficult; people spend most of their time and energy trying to satisfy basic human needs. Many people work two or more jobs to make ends meet. There is also a lack of shelter and an increase in unemployment. Therefore, the NGO community is not very attractive to the public. During the last two years, many of the outstanding environmental activists withdrew from the movement's activity or suspended their membership due to economic and family reasons. According to sociological research on society's environmental consciousness, a great majority of people declare support for ecological values. However, their behavior does not confirm this declaration. This is still the main hindrance for the movement's aims. It is especially difficult to complete activities that require mass support for their success.

Cultural obstacles are another hindering factor. Polish society has undergone dramatic social and political changes, resulting in the lack of a coherent system of cultural values and social norms. There is especially no system of civil values, the force that generally triggers the development of social movements. So the social movements and NGOs appear only in a few specific cultural niches. Therefore, the social movement is weak compared to collective activities; it possesses such strong dignity that it interferes with negotiating conflicts and forces individuals to reject compromises. Among environmentalists, organizational effectiveness holds low prestige. Members are reluctant to join formal activities. Some of the cultural patterns result from the heritage of the past, that is, the survival of the patterns of acting and thinking acquired under real socialism. Among them, passivity and learned helplessness (reliance on the State, its protection and initiatives), an essential feature of "socialist social consciousness," are the most significant. As L. Kolarska-Babinska writes, low participation is caused also by the way political change affects the individual's cognitive and value structure and the relation between them: the past and the present are constantly redefined; the definition of the current situation as well as the prospects for the future are unclear; the hierarchy of values and the identity of individuals and the society are changing; and the rules of behavior are vague, changeable, and inadequate to new situations. As a result, society experiences a state of anomie.

Thus, as we see, there are very powerful factors operating against the creation of a civil society and discouraging mass social participation and activity. As mentioned above, social movements emerge only in specific cultural niches, wherein only the minority of the Polish society seeks values. The cultural and economic background of the socio-political participation presented above explains the lack of social activity and the very low level of organizational consciousness of the Polish NGOs.

The Forms and Aims of NGO Activities: Due to the disastrous environmental conditions, the short-term aims of Polish environmental NGOs are focused mainly on reaction to the most urgent environmental issues that can be solved with relatively limited financial resources and under short term constraints. These urgent issues are mainly the results of industrial and agricultural activities. Some other environmental dangers that are currently being tackled by the NGO community are connected to the process of systemic transformation. The short-term aims of the NGO community are to oppose the import of toxic waste, food, and dangerous chemicals, and to prevent uncontrolled land development. To fulfill these aims, NGOs usually organize protests and direct actions or try to intervene with authorities at different levels. Other forms of activity which fulfill the short-term goals are organizing conferences, and exhibitions and preparing expert reports and press releases on various environmental issues.

Its main middle-term aims are: (1) to improve the information network on environmental problems, both inside and outside the NGO community; (2) to raise the level of skill and knowledge on environmental issues for members of NGO's, local authorities, and representatives of society; (3) to raise the awareness of society on urgent ecological issues, like antinuclear, antifur, and animal rights issues; and (4) to solve some environmental problems by undertaking environmental projects.

Its two main long-term aims are: (1) to improve the environmental situation of the country and fulfill the requirements of ecodevelopment and sustainable development (different NGOs interpret these requirements in different ideological ways); and (2) to create proenvironmental attitudes in society (knowledge, sensitivity, and behavior). Some of the NGOs, especially those associated with "deep ecology" or with the ideas of Saint Francis of Assisi, aim at achieving very deep changes in society's lifestyle and its attitude towards the environment.

The Role of NGO Networks: The level of cooperation within the NGOs, although it has improved in the last three years, is still low. There is an informational network that operates within the NGO community. It works mainly due to the circulation of magazines and periodicals, the activity of a few NGOs whose activities are focused on improving information flow, and the existence of a few informal informative networks, like the subculture networks of the vegetarian and animal rights defenders, ecological experts circles, the student community, the biodynamic farmers, the counter-culture movement, and the "deep ecology" representatives. However, the scope and contents of the environmental network need much improvement. Some of the NGOs are working on this task, but there are still many environmental initiatives and local NGOs that have no access to the informational network.

Radical improvement in coordination of NGO activities is also necessary, although the existence of free will in this issue should be respected. Generally, a great majority of NGOs are both organizationally too weak and reluctant to integrate and coordinate their activities with other NGOs. Improvement of the coordination capabilities should be applied to many fields of activity, like joint environmental campaigns, mobilization of public opinion, ecological projects, protests, and joint pressure on the authorities. This improvement could enable broader cooperation among NGOs and the government on various environmental issues. To prepare for closer cooperation and participation in decision-making processes, the NGOs should increase the level of skill and experience of their staff members and negotiators; there is a special need for greater economic and legal training.

There is also the very important problem of representation of NGOs at the national and local level. For many reasons, not all the NGOs can directly participate in the decision-making process; not all the NGO members can cooperate with the government. Some representatives must be chosen to enable effective participation and cooperation. However, the Polish NGO community is constantly seeking answers to the questions "Is a representative for the movement needed?" and, if one is, "How is such a representative to be chosen?" And, finally, many Polish NGOs reject the concept of direct cooperation with government and participation in the decision-making process. This is their right, and no one should force them to change their positions.

LOCAL DECISION-MAKERS' ATTITUDES TOWARDS HEALTH POLICY: A SURVEY OF PARTICIPANTS IN THE POLISH NETWORK OF HEALTHY CITIES*

Jerzy Karski
Polish Network of Healthy Cities
and National Center for Health System Management
Warsaw, Poland

The Healthy Cities Project, which began in the World Health Organization (WHO) Regional Office for Europe in 1986, now comprises in Europe nearly 40 individual cities and 16 national networks, including one in Poland. In the Project, a city or community declares that it wants to be healthy, and they want to do everything possible to improve environmental conditions and community health status. In Poland, 29 cities throughout the country are members, with a combined population of 6 million (about 14 percent of the country's population). The mean population of these cities is about 100,000. The largest cities in the Project in Poland are Lodz, Krakow, and Wroclaw. The healthy cities deal with a wide range of medical problems, from drug abuse to injuries, and from lifestyle habits to environmental exposures.

We recently conducted a survey of the Polish members of the Healthy Cities Project. Of the 26 respondents, 58 percent were male, and their mean age was about 38. They worked in a number of different professions: 19 percent were physicians, and 14 percent, teachers. The results were as follows. Seventeen (65 percent) believed it is possible to undertake new effective initiatives for health in their communities. Most respondents (86 percent) said that central or local government should initiate local health-related activities. In response to a question about the main general threats to health, environmental pollution was the response of 67 percent of respondents, with much lower percentages stating it was low level of health education, insufficient health care, insufficient funding, or inadequate lifestyle.

When asked about main local threats to health, 38 percent said industrial pollution, 26 percent said air pollution, and 17 percent said water contamination. In response to a question about who should bring about removal of main threats to health, both generally and at the local level, the vast majority said the central or local government. When asked who has sufficient authority to encourage a local community to undertake collective activity for health, the leading answers were: local government (21 percent), medical doctors (15 percent), and the mass media (15 percent). When asked from where should come the main financial resources for the improvement of health conditions and health protection, the majority of respondents said the local and state budgets (39 percent and 34 percent, respectively).

* Co-authors of this paper are Bohdan Wasilewski and Jolanta Pawlak.

INTERFACES OF THE POLISH SOCIETY OF HYGIENE WITH HEALTH POLICY-MAKING INSTITUTIONS IN POLAND

Cezary W. Korczak and Jan Sobótka
Polish Society of Hygiene
Warsaw, Poland

Founding of the Society (1885-1898): The Polish Society of Hygiene began its activities in 1885 with the publication of the periodical *Zdrowie* ("Health"). Up to the time of the official founding of the Society in 1898, two hygiene expositions were organized, the first ones in Central Europe. In 1887, the first hygiene exposition was organized in Warsaw in the area of the Ujazdów Park. Dr. Józef Polak wrote that one of the foremost tasks was the need for adequate protection of public health and improvement of the hygienic-cultural condition of towns and villages. He regarded health problems as highly important in the policy of the State. He claimed—and now we know that he was quite right—that health education is the basis for social progress and wealth of the population. His were the first activities for public health promotion in the period of Poland's partition.

In 1896, the Society organized the second hygiene exposition, which resulted in the founding of the Warsaw Society of Hygiene. The statute of the Society included protection of the health of the society, with particular stress laid on community hygiene, work hygiene, and school hygiene. After 13 years, the Society began its scientific and social activities which have been continued to the present.

The Activities of the Society until World War II: At the beginning of the 20th century, the Society played, in that difficult period of life of the nation, the role of a public scientific institution working on practical introduction and development of the principles of health and hygiene. Independent of the organization of conferences and scientific meetings, very important practical initiatives were undertaken for the protection of public health, including: (a) organization of a sanitorium for tuberculosis treatment in Rudka near Warsaw; (b) foundation of the Institute of Children's Hygiene in Warsaw; (c) organization of playgrounds for children and adolescents in Warsaw and Kracow; (d) foundation of baths for the population; (e) organization of the Museum of Folk Hygiene in Częstochowa; (f) and construction of the building for the Society.

Meetings, Congresses, and Conferences: During the 35 years of its postwar activity, the Society organized over 80 scientific meetings on various problems, including 20 on public hygiene, 10 on health education, 10 on mycology problems, 8 on work hygiene, and 4 on nutrition hygiene.

International Cooperation: The Polish Society of Hygiene has entered into cooperation with the World Federation of Public Health Associations. The president of the Society was the president of the Federation from 1989 to 1991. Cooperation was maintained with the International and European Union of Health Education. In 1990, the II European Conference on Health

Education was organized for about 800 participants, among them 400 from abroad. The proceedings of the conference were published in Polish, English, and French. After participation in the organization of the European Association for Cancer Education, the Society will organize the 7th Conference of this organization in Warsaw in 1994. The Society cooperates with the societies of hygiene in Bulgaria, Czechoslovakia, Germany and Hungary. In cooperation with the Hungarian society, the first symposium was organized in Warsaw, and in 1992, the second one will be held in Budapest.

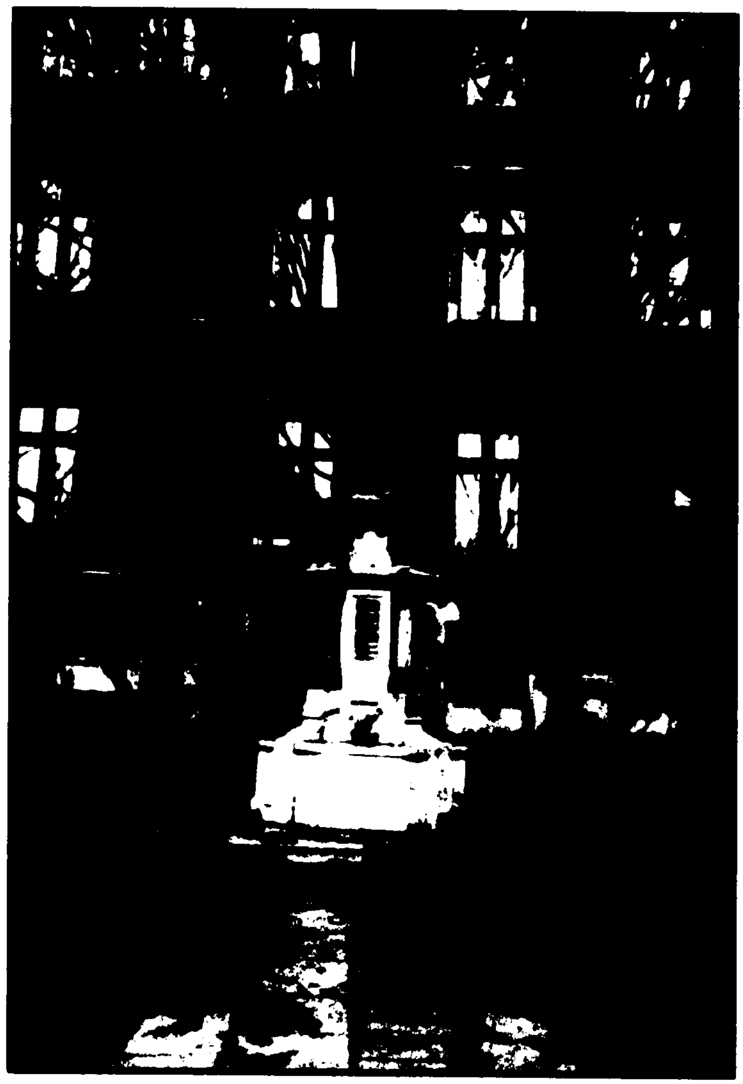
The Publications of the Polish Society of Hygiene: From 1885 to 1939, the Society published 33 volumes of the monthly *Zdrowie*. This periodical is still being published by the Ministry of Health, but the name is now *Zdrowie Publiézne* ("Public Health"). Over the past 15 years, 38 volumes of the periodical *Problemy Higieny* were published, and 5 volumes of *Problemy Higieny Pracy* ("Problems of Work Hygiene") were published.

The spouses Marcin and Wanda Kacprzak gave to the Polish Society of Hygiene their life savings for establishing funds for awards and grants. According to the will of the founders, it serves to help young scientists in education or scientific research in hygiene and public health. This is important for many young doctors who want to do scientific research in environmental hygiene and health protection. The Committee of the Wanda and Marcin Kacprzak Funds of the Polish Society of Hygiene opens competition every year for work connected with hygiene and human environment protection, especially for problems of community hygiene, food hygiene and nutrition, school hygiene, health education, and selected problems of epidemiology. For 32 years, the funds have given 120 awards and 19 grants.

Cooperation of the Polish Society of Hygiene with the Ministry of Health and Social Welfare: Since 1957, cooperation with the Ministry of Health has been concentrated mainly on the problems of hygiene and health protection. The Ministry asks the Society for consultations, opinions, and memoranda on various problems of health services. The last study (December 1991) was on "Prophylactic activities in the aspect of the sanitary conditions of the country and environmental protection." The Ministry of Health provided opinions and sent abroad for scientific meetings many specialists in hygiene from Poland. It supports financially the organization of the congresses of the Society and publications relevant to hygiene. Specialists in hygiene participated in various committees set up by the Ministry of Health. The cooperation of the members of the Society with the Ministry of Health is indicated and necessary, such as in outlining teaching programs, scientific works, consultations, and technical assistance.

The Society cooperates with the Ministry of Education preparing curricula in hygiene and health education, giving opinions on textbooks and school encyclopedias. In cooperation with the Ministry of Education, several conferences on school hygiene have been organized. The presidential board of the Society prepared a memorandum on the need of providing school children with a glass of milk every day. The memorandum was sent to the Prime Minister and to several other similar societies, and was discussed at several sessions of Parliament.

Cooperation with the Federation of Polish Medical Associations: The Polish Society of Hygiene has participated actively with the Federation of the Polish Medical Associations in the organization of over 20 scientific conferences in bilateral cooperation, on such topics as "Human health by the year 2000 according to the WHO programme," "Social rehabilitation and readaptation," "Problems of medical ethics," and "Health education in the opinions of the representatives of medical societies." The Society participates in the work of the Council of the Scientific Societies of the Polish Academy of Sciences. This council groups 220 societies from the whole country. Problems of publications, scientific meetings, and finances are discussed. The Society has 32 branches in Poland that work independently in their respective areas. Polish Society of Hygiene members, for nearly 100 years, have put into practice the principle *Salus populi suprema lex esto.*



Statue of Copernicus at Copernicus Medical Academy in Krakow.

INDIVIDUAL, SOCIAL, AND GLOBAL ECOLOGY IN PRACTICE: THE WORK OF A NONGOVERNMENTAL ORGANIZATION IN CROATIA

Maja Maštrović
Society for Improvement of Quality of Life
Zagreb, Croatia

The Society for the Improvement of Quality of Life is a nongovernmental, nonprofit organization working on projects for improvement of the everyday life of people, their families, and society as a whole. It is engaged mostly in establishing standards and demonstrating ecological and biological values, with the goal of a higher quality of life and more environmental awareness.

The Society has been working for 5 years and has faced many problems and difficulties. The old political system did not recognize it as an organization or its field of activity, and the new political system slowly recognizes it as an initiator of change and an influence on social life but the Government has to deal with the war. However, recently the Ministry for Environmental Protection politically and financially supported its Earth Day project.

The Society works at three levels of ecology: individual, social, and global.

On the individual level, it works directly with people by giving them advice, health consultations, dietary recommendations, and other assistance. The Society has held many seminars, lectures, and workshops, educating people about healthy lifestyles, family, and natural health care, sustainable food, and other subjects. By participating in these programs, many people have found ways to improve the conditions of their own lives—the biggest impact of the society.

The Society is preparing a green consumer guide, a book on how to shop consciously, having the information you need to decide to buy something. In addition to practical advice, it will contain a list of toxic substances with short explanations about their hazard to health. The Society has already published several books on healthy living and individual ecology as well as bulletins on its current projects. It is also preparing a series of simple and attractive green handbooks, that will provide information on waste; recycling; noise; air, water, and soil pollution; and healthy lifestyles and work environments. They will be published on recycled paper. The first handbook has already been published. Every booklet will discuss the problem, what we can do now, and what should generally be done to solve the problem. Those booklets will be distributed free at schools, waiting rooms, and other appropriate places.

For its Earth Day celebration, the Society has been organizing, with the Zagreb Fair (the biggest trade fair in the country), Bioethics—A Fair of Ecology, Ethical Business, and Health. It intends to gather producers of ecological and related products as well as interested consumers. We want to improve the flow of information among them as well as promote ethical business. (With the Zagreb Business School, we organized a round table on ethics in business and ethical business in 1991.) It will convene there the Green Forum of ecological groups and organizations, for lectures, presentations, and discussions on preserving the environment, energy in Croatia in the future, agriculture in the 21st century, and other topics. For the first time this year, responding to the present conditions, the Society had a peace forum, a meeting of peace groups and individuals from Croatia and abroad. They discussed human rights, nonviolence in dissolving conflicts, small wars as dangers to global security, and other topics. Next year, it plans a symposium about biological agriculture.

The Society also organized "Quantum—Spirit, Mind & Body" a 3-day festival of new-age culture, with lectures and workshops, mostly on the topics of a new way of living, a culture of life, and ecological aspects of living. It will become a separate year-long project, with a special program in the summer.

Last year, when the war and the present crisis stopped all our ecological activities and regular programs, we started projects in "social ecology." We made contacts with humanitarian organizations from abroad and managed to get food and medicine sent to areas in conflict.

When the political situation started to get complicated last August, the Society initiated, with the Green Action Zagreb, the Anti-War Campaign Committee (AWCC), which was joined by about 60 groups and individuals from Croatia, other republics of former Yugoslavia, and elsewhere. AWCC organized several public demonstrations and has been involved in establishing a network to connect groups in all the republics. But due to increasing armed conflict and damaged communications links, it has not been possible to establish a functioning network.

The structure of the AWCC has been defined recently and now it is the Center for Peace and Nonviolence, the first NGO of its kind in the country. Generally speaking, the peace movement in the former Yugoslavia has no tradition, except for the Movement for Culture of Peace and Nonviolence in Slovenia. There was a group know as Svarun, which worked in Zagreb between 1986 and 1989, carrying out activities of the ecological, peace, and women's movements.

Last summer, escalation of crisis unexpectedly initiated a strong awakening of anti-war initiatives in all the republics: most of groups and organizations arose in Bosnia and Herzegovina. In Serbia, the Center for Antiwar Action was founded in Belgrade, and in Montenegro, the Citizens Committee for Peace has appeared. Other organizations were also established. All these groups are facing similar problems: pressure from government authorities and the war-oriented parties (especially in Serbia), as well as lack of knowledge, information, experience, and financial resources.

The Society worked on the Message of Peace program and the Foundation of Conscience project, now becoming the Institute for Nonviolent Studies. In our work, we respect ethical principles, such as not judging who is guilty and who is not, helping people in need regardless of their political and religious convictions, promoting human values, speaking for human rights and the dignity of man, and working to save our cultural and national heritage that is being endangered and devastated by the war.

We are considering a transinstitutional project to gather all important organizations concerned with protecting the environment and enabling them to work together on the same programs. In connection with this project, the Model of Environmental Decision-making: A Project for Croatia will start, a research project analyzing the present state of environmental protection in Croatia. The aim of this research is to provide a more efficient (market-oriented) model of environmental policy.

ECOLOGICAL DAMAGES CAUSED BY THE WAR IN CROATIA*

First of all, the war against Croatia can be and must be used as a case study of ecological destruction inflicted by war. All environmental consequences of using conventional and some unconventional weapons are evident in this war. Most of the destruction of the environment is a consequence of a carefully planned and precisely executed strategy. For example, the aggressor has devastated five of the seven national parks in Croatia. In addition, the consequences of soil pollution will not be confined to Croatian territory—it will have a strong impact on much of Europe and maybe beyond.

Destruction of the oil and chemical industry: In September 1991, Serbian guerillas destroyed huge oil tanks in the refinery in Sisak, the largest in Croatia. The amount of burned and spilled oil is a military secret. In many cities throughout the country, the federal army destroyed industrial plants, such as thermal energy plants, the large soil fertilizer industry, the chemical industry, the match industry, some oil and natural gas fields, oil terminals in two ports, tanks with 87 tons of ammonia, many other factories, and many petrol stations throughout Croatia. An aluminum electrolysis plant was seriously damaged and enormous amounts of fluorides and cryolite were released into the sea. In Tuzia, Bosnia and Herzegovina, the largest chemical factory of the former Yugoslavia was bombed, but fortunately none of its reservoirs were hit. The true extent of this ecological damage, especially to the water supply system, is yet unknown.

Contamination of soil: Military experts estimated in eastern Croatia alone, in the first few months of the war almost one million high-calibre shells and bombs were fired, just from the Serbian side. Storehouses of ammunition and explosives in many towns were destroyed, totally obliterating the environment for miles around. If one adds shells fired by the Croatian defenders, contamination of soil and drinking water resources are even more serious.

Deforestation: Destruction of forests was especially serious in the coastal region, mostly around Dubrovnik where the army has deliberately burned out with phosphorus shells almost all forests in that part of the coast, including the Trsteno Arboretum, a cultivated botanical garden that is more than 400 years old.

* From the "Agora," bulletin of the Foundation of Conscience.

Devastation of islands: The National Park of Koranti, a unique archipelago of islands, has been devastated by military ships and naval units. The islands near Dubrovnik were and are under fire from heavy artillery and rockets.

Destruction of wildlife: Protected trees are being senselessly destroyed, rare animal species (especially bears) killed, and fish killed by dynamite. Kopački rit, with its many rare species of birds and other kinds of animals, has been devastated. Fragile ecosystems of national parks and other natural reserves in the continental parts of Croatia are still endangered by the military. Many cows, pigs, and horses were also killed.

Waste of energy: Thousands of military vehicles and dozens of helicopters and military aircraft are wasting enormous amount of energy on their missions of destruction. All the burning fuel, together with burning forests, buildings, and industrial plants as well as fired shells and bombs could contribute to the greenhouse effect and global environmental imbalance.

Rural scene near Pultusk.

OBSTACLES IN TRANSLATING SCIENCE INTO POLICY AND ACTION: A CASE STUDY OF HEAVY METAL POLLUTION IN THE SAJÓ VALLEY

Ferenc Bokros
Public Health Institute of Borsod County
and Green Action
Miskolc, Hungary

Although I work at the Public Health Institute of Borsod County, I am representing here the views of Green Action, a nongovernmental organization. I would like to give you an impression of the major environmental problems in an industrialized county and to present the activities of Green Action.

Total annual industrial emissions in the county are 100,000 to 150,000 tons of sulfur dioxide, and 20,000 to 25,000 tons of oxides of nitrogen. Until 1980, about 14 tons a year of cadmium were discharged into the Sajó. About 600 tons of mercury have been discharged into the environment since 1963; of this amount, 366 tons are still under the soil of the mercury-cathode alkali electrolysis plant, threatening huge groundwater reservoirs. There is destruction of forests around chemical plants in our area. The pH of the soil has decreased one unit during the last 10 years, in spite of treatment with calcium carbonate.

Environmental health problems affect densely populated areas. A study by Szöllösi and colleagues in the early 1980s of 8-to-10-year-old children revealed acute respiratory tract infections and nervous symptoms occurring four to five times more frequently than in reference cities.

At the flue-dust deposit area of a poor quality brown-coal-fired thermal power plant, one can see hundreds of hectares of polluted areas, a desert-like scene, and cows pasturing around them. Wind carries this polluted dust towards Sajószentpéter and Miskolc, the second largest city in Hungary, with a population of 210,000.

Waste containing lead, arsenic, and mercury is seriously threatening groundwater and bank-filtered wells along the Sajó, and may cause heavy metal pollution of cow's milk.

THE MERCURY SCANDAL

The Borsodchem chemical plant and the mercury-cathode alkali electrolysis factories illustrate the history of mercury contamination at Kazincbarcika. About 600 tons of mercury have been released from these plants into the environment since 1963. The amount found in soil—366 tons—is just above the deep layer of a groundwater reservoir. Although according to a study by VITUKI—a water research institute—there is no direct hazard to this reservoir, the potential future environmental health hazards cannot be overestimated.

Other large source for air and groundwater pollution are the huge brine-sludge deposits near the river.

A summary—*Mercury History 1963-1991*—gives a detailed chronology of the events, and clearly demonstrates the important role Green Action and its predecessor played in obtaining pollution data for the water and sediment of the Sajó, and in exposing the problem in the media in 1990.

The public concern in the region helps Green Action in finding former uncontrolled industrial waste deposit sites. Green Action's methods include visiting people living in the area and questioning them about unusual truck loads there, interviewing former factory workers about waste disposal practices, and—what has been proved to be especially effective—taking aerial photographs from hang-gliders. By these methods, numerous "secret" waste deposit sites have been revealed. The "ingenuity" of environmental planning is well demonstrated at one site where the soil was removed and the waste was directly deposited on the sandy gravel area, making leaching out of waste materials even easier.

As for the mercury pollution of the Sajó caused by the effluents from the plant, one may recall the saying that in the 1970s the Rhine River could have been used for development of photos due to the high organic pollutant concentration of the river water. Similarly, the Sajó could well have been used for developing daguerreotypes, a process that normally takes place in the presence of warm mercury. In fact, in that case, more than one ton of mercury was discharged every year into the Sajó—and the water is warm indeed, especially in summer, when the water level is low and a significant part of the water is taken out by a thermal power plant. The plant uses it as a process cooling water, then returns the water to the river, causing a very high heat load.

Green Action, which has played an important role in transforming environmental policy in the region, is now carrying out its 3-year "Heavy Metal Project" to investigate heavy metal pollution sources in the Sajó Valley, determine the magnitude of heavy metal accumulation in the environment, determine possible long-term human health effects caused by heavy metals, elaborate and use biomonitoring methods, and establish a heavy metal data bank.

The most important plan for the near future is the establishment of an independent ecological institute. It will have activities in education (publishing of information brochures); data-gathering (environmental-friendly technologies, environmental pollution, health statistics, and environmental publications); analysis of environmental samples for inorganic and organic pollutants; case studies on critical sites; ecological planning; and nonprofit services for decision-making, hazard and risk assessment, and data management.

We hope that nongovernmental organizations, like Green Action, will help in transforming environmental policy and act as a catalyst, in concerted action with governmental institutes, to solve environmental problems.

A LABOR PERSPECTIVE

Karoly Fulop
Federation of Hungarian Chemical Workers Unions
Budapest, Hungary

I have worked as an economist for 2 years for the Federation of the Chemical Workers in Hungary. My union was established by chemical workers 86 years ago. We organized 80,000 workers altogether, and negotiated for workers in the chemical, pharmaceutical, rubber, plastic, oil, gas, and other industries. There is an ongoing structural change inside our union. All branches have decided to establish their own headquarters and, at the same time, have declared that they are willing to join in the Federation of the Chemical Workers Union. I think it was an important and necessary step to modernize our organizational structure, which will fit to the structure of employees organizations. Employers in Hungary are much less organized, but I am sure that within a short time they will be well-organized.

How can a union improve its effectiveness in policy-making? In the normal way of political life, issues are decided by negotiation. It does not matter where negotiation occurs—a factory, a branch, a county, the national level. The union representative has to be an excellent expert on the negotiated issue with the necessary information.

How can the unions keep their representatives well informed? The answer is with well-organized training programs that involve the whole spectrum of union officers, from the shop steward at the factory level to the special experts at the national level. Without well-organized training programs, the unions are not able to give the appropriate response to new challenges.

Unions should collaborate with scientific institutions when they plan new training and they realize that their own knowledge is insufficient to manage the new course on their own. Also, they should ask for the assistance of scientific institutions when they would like to be more informed on certain issues. Let me give you an example. Our union is affiliated with other trade unions. Our federation, among six others, plays an active role in the work of the National Reconciliation Council of Interests. This is a three-part system: the Government, and employee and employer organizations. The representatives of the these trade unions took the initiative to the table of the National Reconciliation Council of Interest, which is concerned with the future of occupational health in Hungary. The National Institute of Occupational Health, the Hungarian Scientific Society for Occupational Health, and the Factory Doctors Section of the Hungarian Medical Chamber contributed to this effort.

In this stage of transition to the market economy, labor unions in Central and Eastern Europe can also rely on the experiences of labor unions in industrialized countries. As capital becomes more and more multinational, it is necessary to take the advantage that can be gained from the international solidarity of labor organizations. This means much more than expressing our solidarity when, say, a group of workers suffer under employers' actions somewhere in the world. Of course, solidarity actions have their own importance.

There are many other practical advantages to international solidarity. Let me give you an example to make it more clear. Since 1990, our union has been affiliated with the International Chemical Energy Workers (ICEF) Federation. This federation represents workers all around the world in more than 80 countries, with more than 6 million members. The ICEF has just expanded its activities in Central and Eastern Europe. In a Dutch-Hungarian joint venture established two years ago, management refused to give the full list of ingredients to be used in the new technology. Therefore, the hazards of materials were unknown. We asked the Dutch Federation of Industrial Unions, affiliated with ICEF, to pressure the management of the Dutch company to provide the necessary information. Believe it or not, in two weeks' time we got it.

Let me give you another type of example of international solidarity. A large American chemical company decided to play an active role in Hungary. So, it came to Hungary to buy a Hungarian State-owned chemical firm, United Chemical Works, which mainly produces household chemicals. When we first heard about this plant action, we had sent an e-mail message to the head of ICEF to obtain any company information available. We had also asked ICEF to ask its affiliates in the United States for the other available company agreements. In two days' time, we received by e-mail this information with data on balance sheets, company structure, articles of market action, and other subjects. A week later, we contacted the American Oil, Chemical, and Atomic Workers (OCAW) Union, which is affiliated to the ICEF. As a result, the American management was very surprised during its first visit to the large Hungarian firm about how well informed the local union officer was on its activities around the world and on working conditions of workers at the same company in the United States.

In conclusion, a labor union can improve its capabilities and implement some policies if it is able to follow continuously the changes in the world at work, and if it has highly qualified and well trained negotiators to obtain the necessary information. Also, if solidarity works well inside the union and through its widespread foreign contacts, it can gain practical results from international solidarity as well. Finally, if the union is well organized with satisfied members, the union can mobilize its members for various needed actions.

RISK COMMUNICATION AS A DEMOCRATIC PROCESS

Judith A. Perrolle
Department of Sociology and Anthropology
Northeastern University
Boston, Massachusetts, USA

Normally, risk communication is not a democratic process. It is based on the idea that risk is real, that it is easily measured, that scientists can agree on risk, and that all you need to do is to translate scientific knowledge into education for the public. In technical terms, this conventional approach to risk communication is based upon positivist conceptions of the nature of risk. It assumes that risks are unambiguously real and measurable, and that a community of scientific risk assessors can agree on their seriousness. However, this is not usually the case, as we have heard during this symposium in some discussions about instrumentation and the measurement of toxic chemicals. This is not a very democratic process; it goes in only one direction. The political process of risk management is reduced to questions of how policy-makers can provide information to the public so as to change individuals' risky behavior. Risk communication is used to legitimate bureaucratic actions (or non-actions) to mitigate hazards. A more democratic process of risk communication involves free discussion and debate.

WHAT ABOUT RISK CAN BE DETERMINED BY DEMOCRATIC PROCESS?

Risk communication is part of a larger process of understanding and managing hazards. The sequence of risk definition, risk assessment, risk communication, and risk management is a political activity during which risk is socially constructed. What this means is that people collectively form concepts of: (a) what risks might exist (and therefore should be scientifically assessed); (b) what risks do exist (based on some socially approved knowledge—which may not be scientific); (c) how serious risks are (partly a subjective decision about what dangers are acceptable); and (d) what should be done about them (individually or organizationally). In a democracy, these decisions are theoretically determined by a fair process involving all those affected. Working together, scientists, workers, public health officials, political representatives, and ordinary citizens can define, assess, and manage risk.

Possible New Risks (What should we use scarce scientific resources to study?): The idea that risk should be determined only by scientists is very illogical. This is because, in order to have scientific knowledge, we must have scientific data. But before we have data we must have research. And before we have research we must have money. Who gives us money, and why? Because someone thinks that our research is worthwhile. How do we show that our research is worthwhile? We use scientific facts to show it. Somewhere in this cycle we must begin. Usually, the definition of new risks begins with a social process.

For example, some people are afraid of computers. They ask the questions: Is there a health hazard of video display terminals? Is there a health hazard of extremely-low-frequency (ELF) electromagnetic fields? We do not know the answer to these questions, and we will not find out unless somebody will pay for the research. When people become very angry, when the newspapers print stories, and when the unions make demands, then scientists get some money and begin to develop scientific knowledge. This is what I mean by saying that possible new risks are socially defined in the democratic process. If we do not have the democratic process, government and business officials may prefer it, because there will be no new risks. New technologies will seem risk free, because their possible hazards will not be studied. A democracy that allows free discussion and debate and has leaders responsive to public demands will evaluate new hazards.

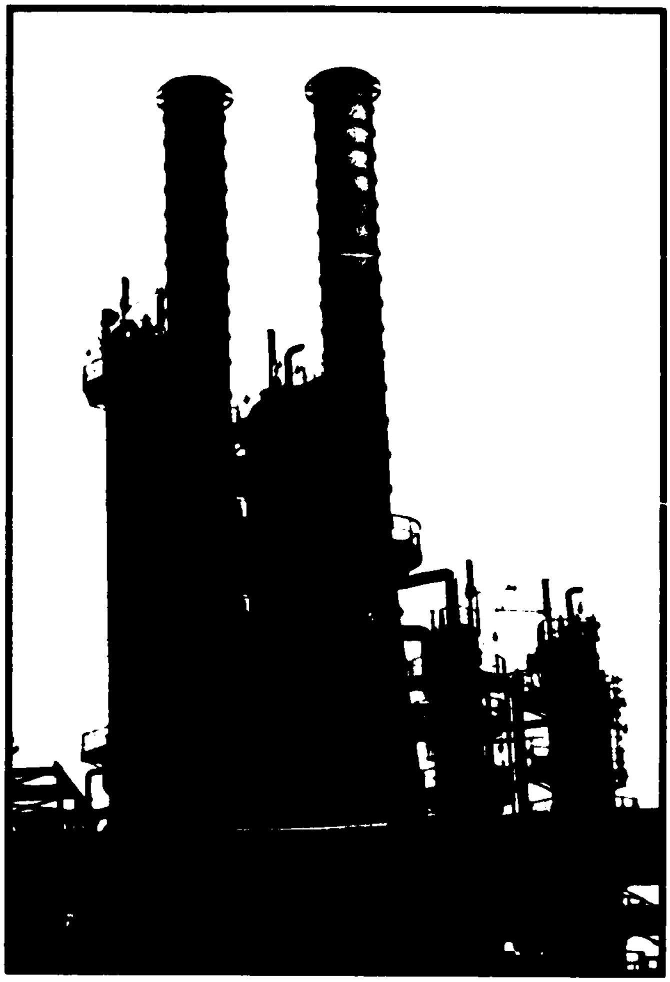
Socially Agreed Upon Knowledge (What is the truth about risk? How do we know?): Scientists sometimes have trouble with the idea that knowledge is made socially. We think of knowledge as based on truth. The truth is "out there"; we only need to go look at it. Well, as we saw when participants in our symposium discussed the proper procedure for measuring the carcinogenicity of a compound, even scientists must negotiate truth. How shall we understand how to measure this phenomenon? Which theory will scientists decide to use this year to understand the world? In other words, there is negotiation among the community of scientists about the nature of their truth. Ordinary people also have religious truths that are given by God (presumably) to religious authorities and come in some other ways to be considered true. We have the social knowledge of common sense—what everyone knows. Scientists do not usually study that. Sociology is an interesting subject because we do study what everyone already knows. Many of the things that people all know about risk are not true in the scientific sense. Common sense about risk causes people to ignore serious dangers and to worry about small problems. Through democratic risk communication, scientists can educate the public, while at the same time the public directs scientific research towards its concerns.

Acceptable Risk (How safe is safe enough? For whom? Who decides?): Once we let scientists do their work, studying things that we are afraid of, then we have some numbers. But knowing how safe we are is not what we want. People, especially those responsible for action, need to know: is it safe enough? Or must I do something to make it safer? Scientists and risk assessors cannot tell us that. Scientists can tell us how many parts per billion of a toxic substance are in our water. They can tell us how many rats died from drinking the water and how many rats became insane (if we decide that a rat which runs forever in circles is perhaps not a socially well-adjusted rat). But they cannot tell us if the water is safe enough.

As an example of this problem, there was a meeting in a town in the United States. Representatives of a chemical company came to town to tell the people that their plant was safe. The company's representative said that there would be no more than one cancer extra per 100,000 people; it was a very safe plant. A woman in the audience stood up and pointed her finger at the company representative. She said: "I hope that you are the one." People have different concepts of how safe is safe enough. One cancer per 100,000 is not safe enough if you are the one.

Unfortunately, people with not much education about risk want zero risk. They insist on no risk at all. As most scientists and experts know, this is not possible. So we must have some risk. Determining the level of appropriate risk is not the scientist's job. And it is not really the risk assessor's job. So who decides? A democratic assessment of acceptable risk requires a social process to communicate to everyone involved in the decision what levels of risk are possible and at what costs. A democratic decision about how much is safe enough is made by the people affected, not for them.

Risk Management (What is to be done or not done? Who is responsible for acting?): Risk management is the question of what is to be done or what is not to be done. It is also the question of who is responsible for acting or preventing action. In a democracy, these issues are not simply questions of pacifying an angry public or telling plausible lies to a work force. In a democracy, we must have institutions and procedures for agreeing on risk policies and selecting individuals and organizations with the responsibility for implementing these policies.



Scene at oil refinery at Płock.

REQUIREMENTS FOR DEMOCRATIC RISK COMMUNICATION

Risk communication is part of a public discussion that shapes our concepts of and responses to risk. Even in a democracy, this discussion is distorted by powerful economic, social, and political interests that try to control public perceptions and actions for their own purposes. For democratic risk communication to occur, several criteria must be met:

1. The language of risk discussion must be understood by all (not hidden in scientific or bureaucratic terminology).

2. Individual and organizational behavior change must be socially influenced. (Risk information from experts often does not change individual behavior. Standards without enforcement do not change enterprise behavior.)

3. Social rationality and scientific rationality must be integrated (including moral and social values, not only economic cost-benefit analysis).

4. Trust is necessary (not propaganda or distorted communication by special interest groups and organizations).

5. Conflicts will occur and must be resolved by democratic procedures. (Risks will exist and will be distributed unequally.)

A Common Language in which to Discuss Risk: The language of risk communication must be accessible to all participants. In particular, scientists must translate their statistical evaluations into lay terms and bureaucrats must avoid hiding behind obscure jargon or legal terminology. The languages used by risk assessors, bureaucrats and politicians, and members of the public are so different from each other that communication is difficult. In addition, the underlying cognitive understanding of risk by these groups differs. It is not merely an issue of educating the public in a special vocabulary, but it involves different concepts of risk, causality, and behavior.

Even when people speak the same language, a word, such as responsibility, may mean different things to different people. In order to have a democratic discussion of risk, we need one language to talk about risk. We cannot simultaneously have the different languages of "parts per billion," the language of cost-benefit analysis, and the language of "my children." We must find some common ground.

An example of this occurred in the city in which I live—Cambridge, Massachusetts. There was a community meeting about water quality. The city hired a toxicologist, a nice young man, to evaluate the water. He came to the meeting with his report. He told us there were this many parts per billion of that and that many parts per billion of this. He talked on and on. When he came to the end of his talk, he said that all of the levels were within the standards set by the United States Environmental Protection Agency, so the water was safe. And he smiled, because he had done a good job, and because the water was safe. Members of the city council and citizens in the audience began to yell at him. One man said: "I do not want to hear about parts per billion. I want to hear if it is safe to drink—yes or no? And if you say "yes" and I drink it and become sick, I want to take you to court and sue you or put you in jail." Well, the toxicologist was not used to this sort of treatment because he was a scientist (and scientists never become angry). But he was a very clever young man, so he said: "I will let my children drink it." Now that is risk communication. That is translating the language of "parts per billion" and standards and estimations and evaluations into the language of parents and morality and community. If a scientist lives in Cambridge, has children, and says that his children can drink the water, then the people understand what parts per billion mean. We need a common language of risk if we are to have democratic participation in making decisions about risk.

Democratic Social Influences on Behavior: Many people assume in risk communication that when you tell people the probabilities you finish the job. However, social scientists know that if you tell people something, knowledge does not necessarily change their behavior. Setting standards does not necessarily change organization or industry behavior. There is a well-documented gap between attitudes and behavior. Informing the public of facts about risky actions does not necessarily make them act more prudently. Programs to change individual behavior, such as smoking or wasting resources, should reflect social and psychological research on how to change actual behavior. We need social forces to influence people and enterprises in order to make them act on their knowledge of risk.

As an example, let me use smoking. Although I am a smoker, I teach my students about the risks of smoking. The contradiction between my knowledge and my behavior is part of what I am trying to teach them. I know about smoking, but it has not changed my behavior very much. But in the United States there are things that have changed my behavior. One of them was the Surgeon General's report on passive smoke. It showed the health effects on non-smokers of breathing other people's smoke. When that report came out I quit smoking for 3 years out of a sense of social responsibility. Even after I began smoking again, I did not smoke in other people's rooms. Another form of social pressure is the way people treat one another. Most people in the United States do not like smokers very much. They treat smokers as drug addicts. If you are a smoker, people look at you strangely and make you feel bad. Gradually smokers are becoming embarrassed about bad social behavior. These kinds of social pressures lead to regulations and laws that help change the behavior of even socially irresponsible people. I participated in the movement to make our university a non-smoking workplace. Cambridge has passed laws forbidding smoking in most public indoor places. The federal government banned smoking on airplanes. Now I smoke less because there are fewer places in the United States where I am allowed to smoke.

A very important part of risk communication is the way people communicate to one another about what is acceptable and what is not acceptable in terms of behavior and responsibility. Such communication eventually affects even the behavior of those who do not want to change.

Integration of Social and Scientific Rationality: The analysis of forms of rationality is based on some rather technical points in social theory, but the implication of social theory for risk communication is that we must think about rationality in terms of moral and social values. The conventional approach to risk communication assumes that people are motivated by a classical economic rationality closely linked to actual behavior. It also assumes that economic and governmental institutions and officials are working in the interest of the public rather than for their own profit or power. However, the form of rationality used by groups at risk is different from the scientific rationality of the risk assessor. What is rational to a bureaucrat, an economist, a politician, a labor official, or a risk assessor is different from what is rational to a parent, a worker, or a community resident. Risk communication must avoid assuming the economic rationality of capitalist enterprise. Health, safety, and secure social relationships are often preferred goals over profit and productivity. This is especially the case when one group's profit is secured at the cost of another group being put at risk.

When people judge conduct and judge desirable outcomes, they think about more than money and economic benefit. There are other considerations. Moral values, social customs, and ethical beliefs are all involved in how people arrive at rational decisions. For example, in cost-benefit analysis we often look at something and say that this will kill five workers, but it will save 10,000. It is a good piece of equipment. But if the police come to my house to arrest me because I have killed five workers with my gun, it does me no good at all to say that there were 5,000 people whom I did not kill. When we are evaluating moral behavior, we think that killing someone is terribly wrong. We are expected not to kill. Even more relevant to risk assessment, if you kill someone with your automobile, it is usually considered an accident. If you kill somebody with your machine gun or with your knife, it is usually considered murder. Yet you killed a person in both cases. How we evaluate the damage done to people and the seriousness of it is not based on the numbers of dead and injured. It is the moral meaning of those numbers that matter to people and to communities. The social meanings of harm must be considered if we are to make any democratic decisions about risk.

As an example, although I am not a Catholic, I understand that in Catholic countries there is some moral difference between whether you murder someone or whether you walk by as someone is being murdered by another and do nothing to help. Even though in both cases your actions are related to the death, in one case you have acted in order to cause harm and in the other you have failed to act to prevent harm. One is a more serious sin than the other. This is typical of moral evaluations in non-Catholic countries as well. It is much worse to cause harm than it is to fail to act to prevent harm. Some of that thinking has worked its way into our sense of environmental protection. A society's moral and legal codes incorporate its definitions of causality and responsibility for harm that is done. Risk assessment must include these elements.

Trust in the Providers of Risk Information: Economic and political interests of bureaucrats and leaders do not always correspond to those of the public to whom risk communication is directed. In extreme cases, risk communication is interpreted as corporate or government propaganda. Risk communication must be trusted by the public. It cannot be trusted if it is used as a legitimation instrument by powerful interest groups or repressive organizations.

Trust, especially in Central and Eastern Europe, is the most important criterion for democratic risk communication. Countries in this region are leaving systems where many old structures that communicated risk to the public were arms of propaganda. In the United States, we have a similar problem when our business enterprises perform risk communication. No one believes them; it is propaganda. We even have this problem with some government agencies that are supposed to be responsible for occupational and environmental health protection. We all need to have institutions that provide technical information and translate it into ordinary language that we can believe. We need scientists and public health officials and agencies that have some dignity and respect among the public in order to be able to perform evaluations together and to maintain democratic processes for evaluating risk. These are difficult to develop if a country is starting from a situation in which there has not been very much trust.

Democratic Mechanisms for Conflict Resolution: There is no single "public" for risk communication, but rather different groups with differing interests and perceptions. Choices about acceptable risk rarely serve everyone's interests equally. In democratic risk communication, conflict is inevitable and therefore some democratic means of conflict resolution should be established. To use risk communication as a pacification technique may reduce the expression of worker and community concerns, but it undermines the democratic process.

Risk communication is often used in the United States by people who want public conflict to disappear. They want to hire a technical expert to tell people some numbers and assure them that they are safe. Then everyone can go home. But in the real world there will be conflicts because risk exists. We cannot eliminate it. It is not divided equally among all of the people. So in every situation of possible harm or damage, some people will be more at risk than others. Some people will be more economically or politically advantaged than others. In this context, conflicts are inevitable. Mechanisms for conflict resolution are needed. I cannot recommend the American version because we like to go to court and take many years to do things. Other countries are more successful at negotiation and arbitration—finding ways for people to meet, bargain, and ultimately agree. Some mechanism for resolving conflict must be found. We cannot have a risk assessment process that has no conflict in it. If you see a risk assessment process without conflict, then someone is telling lies and not listening to what other people are saying. Generally risk communication is a one-way, undemocratic process. However, communication is a democratic process, people are cooperating to search for levels of risk as low as they can afford to pay for, and at the same time looking for risk that is distributed in a way that meets their social standards of justice. Both of those elements must be incorporated into a democratic process of risk communication.

DISCUSSION

A Participant: How can one discriminate between individual risk and population risk?

Dr. Perrolle: As a sociologist, I look at the process by which people understand risk. Individual risk is risk that people feel applies to themselves personally, or else it is the risk of concern to your child or to this specific worker or to your neighbor. Population risk is not understood in personal terms, and it is only vaguely understood in mathematical terms. For most people, risks of hazards to people we do not know are in a different moral and social category than risks to those we do know. It is unfortunate that, like most other human beings, numbers of people who might die in coal mines to keep my house warm somehow do not have the same effect on me personally as the possibility that my child might die. This is part of the social nature of risk perception. We experience individual risks quite closely in relationship to those we know face-to-face. Individual people have difficulty imagining what population risk means. So perhaps the solution is to try to humanize population risk by turning numbers into examples. Bring people a coal miner with black lung disease to talk with. Then they can understand what the epidemiology of coal mine diseases really means. One of the reasons that the media is successful at arousing public concerns about risk is that the press and TV communicate risk in a personal way through their stories about specific individuals.

BACKGROUND READING

1. Clarke, L. 1989. Acceptable Risk? Making Decisions in a Toxic Environment. Berkeley: University of California Press.
2. Dietz, T., et al. 1990. "Risk, Technology, and Society," in Riley E. Dunlap and William Michelson, eds. Handbook of Environmental Sociology. Westport, CT: Greenwood Press.
3. Douglas, M. 1985. Risk Acceptability According to the Social Sciences. New York: Russell Sage Foundation.
4. Fischhoff, B. et al. 1981. Acceptable Risk. NY: Cambridge University Press.
5. Golding, D. et al. 1992. "Evaluating Risk Communication: Narrative vs. Technical Presentations of Information about Radon." Risk Analysis 12:27-35.
6. Jasanoff, S. 1986. Risk Management and Political Culture. New York: Russell Sage Foundation.
7. Nelkin, D. ed. 1985. The Language of Risk. Beverly Hills, CA: Sage Publications.

MODES OF PUBLIC PARTICIPATION: RIGHT-TO-KNOW

Barbara Felitti
Thermo Consulting Engineers
Williston, Vermont, USA

I will present information about the United States experience with "Right-to-Know" legislation, specifically define the term "Right-to-Know", discuss the major federal Right-to-Know regulations and their provisions, and identify some implementation issues we have faced.

How do we define Right-to-Know? Individuals or communities have the right to receive information about chemical hazards to which they are or might be exposed. Right-to-Know is about information. Having and understanding information is essential to be able to fully participate in a democratic process. Right-to-Know in the United States is defined by federal regulation in two major areas: Worker Right-to-Know and Community Right-to-Know.

Why do workers need the right to information? In addition to democratic principles, there are also significant financial reasons for employers in a market economy to be concerned and interested in Worker Right-to-Know. In 1988, the cost of occupational injury and illness in the United States was $40 billion for workers' compensation and wage replacement. The costs for injury and disease cannot be separated; however, the magnitude of the problem is apparent. Additionally, in the United States, the costs associated with occupational illness are underestimated because we do not have in place a good system for identifying occupational disease. Therefore, the cost for occupational injury and disease is actually higher than what is reported.

Why do communities need the right to information? There is a historical perspective on this question. In 1984 in Bhopal, India, there was a methyl isocyanate release at a Union Carbide plant that killed and injured thousands of people. In the United States, people thought this was a tragedy, but felt "it could not happen here." Shortly after, however, at a Union Carbide plant in the state of West Virginia, there was a similar type of release of methyl isocyanate. The release was not serious and no injuries were associated with it. But it made people in communities begin to ask many questions, such as: What else do you have in the plant? How much do you have? Where else are you operating with the same hazardous chemicals?

These concerns about workers' exposures and chemicals in communities, along with a broad-based coalition of health professionals and workers, led to two different regulations: for workers, the Hazard Communication Standard, an Occupational Safety and Health Administration (OSHA) regulation; and for communities, the Emergency Planning and Community Right-to-Know Act (EPCRA), an Environmental Protection Agency (EPA) regulation. The result is that the concept of Right-to-Know is administered by two different agencies, one occupational and one environmental.

Worker Right-to-Know: The OSHA Hazard Communication Standard was passed in 1986. The Standard applies to (1) chemical manufacturers and importers; and (2) employers whose workers are exposed to chemical hazards in the workplace. It is important to note that the United States requires chemical importers to comply with this United States regulation. The Standard has three major provisions:

1. Material Safety Data Sheets (MSDSs): OSHA requires chemical manufacturers and importers to provide specific information to anyone who uses their products about chemical/physical properties, health hazards, precautions for safe handling, and worker protection.

2. Container Labelling: Manufacturers and employers are required to label all containers with information about chemical hazards of the contents. Labelling does not apply just to drums. At the petrochemical plant that we visited in Plock, a colleague noted that the pipes throughout the plant were not labelled to identify content or direction of flow. In the case of an accident, this information can be critical to providing an effective response.

3. Training: Employers are required to provide training to workers about what hazards they are exposed to, how to detect hazards, how to protect themselves from hazards. In addition, they must provide MSDS information and make MSDSs available to all employees.

This standard addresses many critical issues. However, there are often problems with the implementation of good regulations such as this one. Implementation issues include:

- Reliance on Manufacturer's Data: Manufacturers are responsible for preparing the MSDSs and determining the type of protective clothing required. This may be a problem in the area of worker protection. The manufacturer may not want to recommend elaborate monitoring procedures or equipment that might make use of their chemical product undesirable. Additionally, the data focus on irritant and recognition levels, which are signs of acute exposure, but do not address the issue of chronic exposure problems.

- Trade Secret Claims: In a competitive market economy, several manufacturers may make similar products, such as cleaning agents. A company may claim that it cannot identify the constituents of a chemical product because it would destroy their marketing advantage over other companies.

- Compliance and Enforcement: OSHA has not identified how well companies are complying with this regulation. Due to consistent cuts in OSHA's enforcement budget over the last 12 years, this situation is unlikely to improve in the near term. (It may improve under the Clinton Administration- Editors.)

- Right-to-Act: Having information is only the first step. Workers need to be able to act on the information they have received—such as refusing to continue work that results in hazardous exposure, without fear of losing their job.

Community Right-to-Know: The Emergency Planning and Community Right-to-Know Act has four major provisions: (1) Emergency Planning, (2) Chemical Use Reporting, (3) Chemical Inventory Reporting, and (4) Toxic Chemical Release Reporting. The first two provisions are part of emergency planning and require large users of chemicals to provide emergency plans and MSDSs to state and local governments and to local fire departments. Fire departments are most likely to be the first on the scene in the event of an accident. This information is critical for firefighters to develop an appropriate response plan. Large users of chemicals are required to provide annual reports to federal and state governments which summarize the quantity of chemicals used and stored at their facilities. Toxic chemical release reporting requires annual reporting of all discharges above regulatory limits. This includes discharges to all media—air, land, water, underground injection, or off-site disposal. This reporting is a mass balance of chemicals coming into and out of a facility in the form of products or releases. In 1990, the most recent year for which data are available, industries reported the release of 2.2 billion pounds of toxics into the environment. The chemical industry is the largest contributor (1.6 billion pounds) to this amount.

Chemical inventory and toxic chemical release reporting data are made available by the EPA to the public. The toxic chemical release reporting data, issued as the Toxics Release Inventory (TRI), has been used by the public to gather information about and monitor industrial activities in their communities. According to the chairman of the Chemical Manufacturers Association, the largest chemical trade organization in the United States, the increased accountability of industry to the public has had a positive impact in making industries more efficient and competitive.

Some of the implementation issues for community Right-to-Know are similar to those for workers under the Hazard Communication Standard. These include:

- Limited number of chemicals that are subject to reporting: Only 330 of approximately 60,000 chemicals in use.

- Accuracy of release inventory data: EPA has identified a degree of error associated with the data due to changes in methods of calculations and accuracy of company reporting, which makes year-to-year comparisons difficult.

- Trade Secret Claims: As with Hazard Communication Standard, a company may feel that providing toxics release data will identify constituents of their products and undermine its competitive advantage.

- Compliance: EPA estimates that only 67 percent of industries that are required to comply are actually reporting.

With these laws in place, what are some of the next steps we need to take in the United States?

1. Right-to-Act: Providing information is only a start; workers must be able to take action based upon information without fear of losing their jobs.

2. Consumer Right-to-Know: Proposition 65 in California, a requirement for consumer product labelling, is an example of a law that provides information to consumers about hazards of everyday products.

3. Pollution Prevention and Toxics Use Reduction: Before the TRI, we did not know the magnitude of chemical use and environmental releases in the United States. Through TRI, knowledge about chemical hazards and the quantities of chemicals released has helped citizens and government agencies in their efforts to reduce toxics use. For example, statistics from TRI data provided major input into chlorofluorocarbon phase-out decisions.

Right-to-Know in the United States began with Worker and Community Right-to-Know regulations. Right-to-Know is a process of providing information, acting on information to protect health and safety, and identifying new directions for health and safety.

DISCUSSION

A Participant: Who collects and pays for the cost of compiling information?

Ms. Felitti: The Toxics Release Inventory data is submitted to and compiled by the federal government, who is required by law to make this information available to the public. The information is also available through computer databases and networks. The information is primarily available at the state level, and NGOs or other organizations generally provide the information to citizens.

Professor Fina Kaloyanova: I have three questions: (1) Who is responsible for preparing the MSDS and determining what information is required? (2) Are MSDSs required for all chemicals? (3) Why aren't the release data you discuss used for workers?

Ms. Felitti: (1) The manufacturer or the importer is responsible for preparing the MSDS. OSHA has specified what information is required, so there is consistency in the type of information, but the format for presenting the data is not specified. This can create problems for workers who use MSDS prepared by several manufacturers; it is more difficult to use the MSDS when the data are presented in different formats. (2) MSDSs are only required for a small percentage of the 60,000 chemicals we use. This includes chemicals with Threshold Limit Values (TLVs or exposure limits), as well as some chemicals regulated under other laws. (3) I believe that the use of the Toxics Release Inventory data are related to the regulation and agency it is collected under. TRI data are prepared for the Environmental Protection Agency (EPA) under the Emergency Planning and Community Right-to-Know Act. Information for workers is regulated by OSHA.

THE GOVERNMENT'S ROLE AS HEALTH ADVOCATE AT THE LOCAL LEVEL

Jane Riggan
Environmental Health Investigations Branch
California Department of Health Services
Emeryville, California, USA

Rather than specifically address the role of health advocacy, I will raise some issues that I consider to be of great importance in the arena of environmental health. I am called a community relations coordinator, which is a "soft" title. I received my degree in social work in the mid-1960s and, after two years as a medical and psychiatric social worker, decided that I needed a broader context in which to work. Since that time, I have worked as a planner, community organizer, health educator, administrator, and political aide, have always worked in settings that were health-related, and all of my jobs have required that I develop a process that encourages people to work together in pursuit of a common goal.

There are many hazardous waste sites in the United States. The United States Environmental Protection Agency (EPA) has identified approximately 1500 sites as being the most hazardous sites in the United States and placed them on the National Priorities List (NPL). In addition, there are at least 35,000 sites that have been identified as potentially hazardous, and could ultimately be listed on the NPL. In California, there are over 100 sites on the NPL. The EPA is the federal regulatory agency that is responsible for investigation and clean-up of hazardous waste sites on the NPL. In laws promulgated in 1980 and 1986, the Congress of the United States created another federal agency, called the Agency for Toxic Substances and Disease Registry (ATSDR). One of the primary mandates of this agency is to provide public health oversight by reviewing the public health implications of the sites listed on the NPL.

The Environmental Health Investigations Branch of the California Department of Health Services, in which I work, has an agreement with ATSDR to perform health assessments at the sites in California that are listed on the NPL. The health assessment—as distinguished from a health study—is a general and blunt screening tool used to evaluate: (a) how dangerous the substances at a site are to humans; (b) whether there are high levels of these substances; (c) whether workers at the site and residents around the site can be exposed to the substances; and (d) whether the community around the site has health concerns that are related to the site.

Our health assessment project team is multi-disciplinary and includes an administrative team leader, a toxicologist, an epidemiologist, an industrial hygienist, a community relations/health education person (me), and a clerical support person. We also work closely with the physicians, exposure assessment experts, and epidemiologists in our branch, and we have access to the state laboratory facilities as well as experts in specific areas of risk and exposure assessment.

There are three steps in the health assessment process:

1. reviewing all the environmental data (soil, air, and water) that have been gathered by the regulatory agency;

2. reviewing any available health data, including those from cancer and birth defects registries as well as health studies; and

3. talking with the workers (if the site is still active) and residents surrounding the site to find out about health concerns. These health concerns can relate to symptoms, to water quality, or to eating vegetables grown in the yard.

The health assessor takes the above information and draws conclusions about whether the site poses a public health problem. The process requires creativity in the development of solid scientific conclusions. The health assessment must be scientifically credible if it is to be of any assistance to the regulatory agencies in evaluating public health implications of the site. On the other hand, it is supposed to be written in a style simple enough for the general public to understand. That is asking a great deal from a single document. I believe that our health assessments are scientifically credible, but that only a very sophisticated audience could understand these documents. Part of my job is to make the information in the health assessment accessible to the public.

Now that I have presented an overview of the health assessment project, I would like to make several observations:

Public Health: I like to think that what we do is to provide a "public health conscience" to the whole process of hazardous waste site remediation. What we do has a different focus than what the regulatory agencies do, but the two groups are complementary in their work. The regulatory agency starts with a physical site, gathers environmental data related to that site, and tries to determine how the contaminants have impacted the environment, both on and off the site. Their goal is to develop a clean-up plan that, within technical, legal, and financial constraints, will aim to protect the health of the public. The health assessment focuses on the human beings living around the site. It starts with an evaluation of the quantitative environmental data but goes on to characterize those impacted by the site by using demographic data to identify particularly sensitive populations, by gathering health concerns of residents and by analyzing any relevant health data. The health assessment thoroughly explores the toxicological implications of the contaminants and whether there are human exposure pathways that allow the contaminants to reach the residents living around a site.

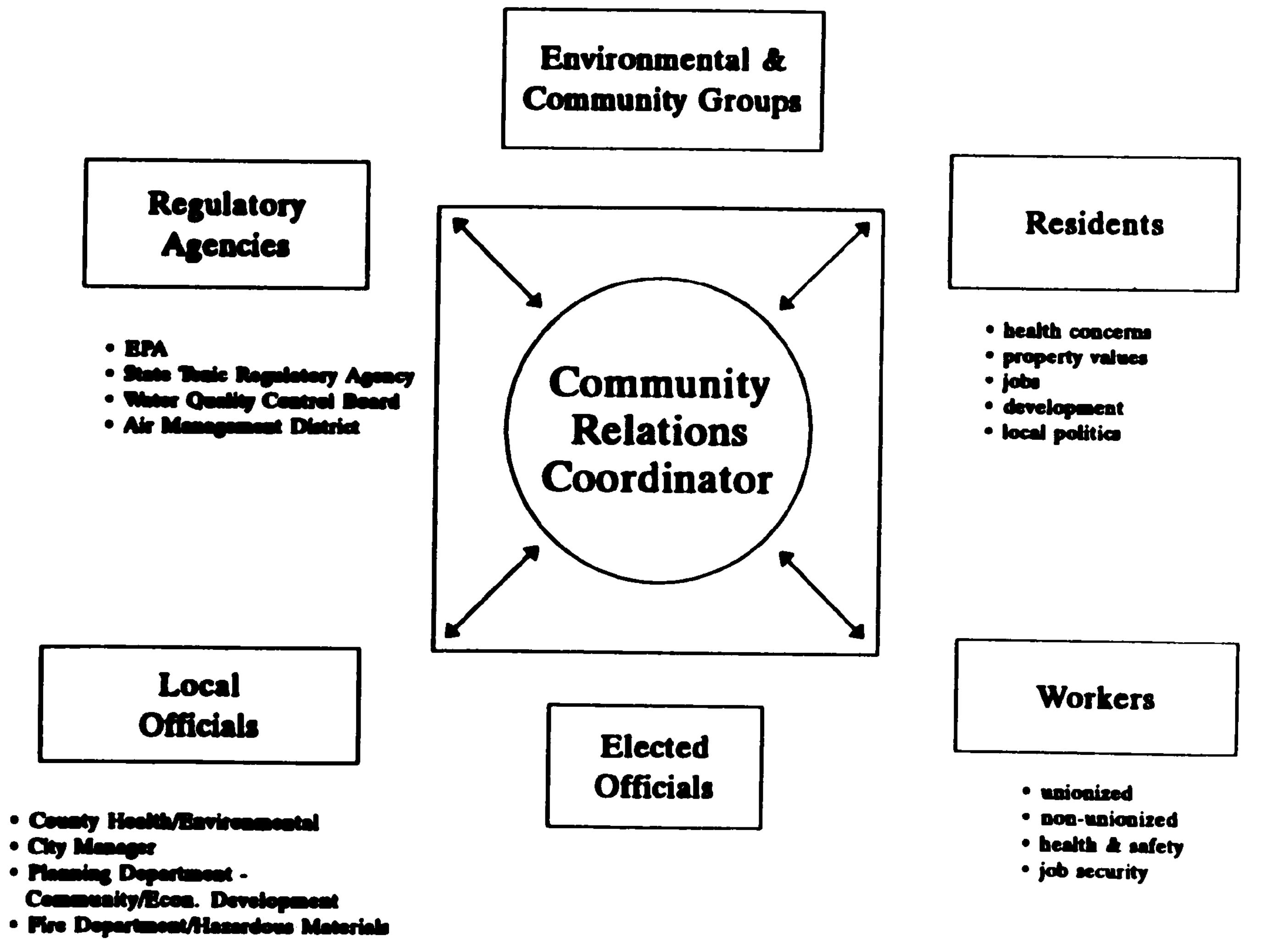
I believe that the health assessment process is a type of health advocacy. An entire section of the health assessment is devoted to community health concerns. The concerns of the residents (workers) are taken seriously and often influence the course of the investigation and the recommendations in the health assessment. Evaluating from a public health perspective rather than a remediation or clean-up perspective can influence which type of sampling is most appropriate. We have been working cooperatively with the regulatory agencies to include sampling that would better characterize human health exposure pathways (the soil sampling of surface soil in people's yards and dust samples taken from homes). Even the definition of what surface soil means can differ between the public health and remediation perspectives. For clean-up, it might be important to sample soil down to 12 inches, but for a human exposure perspective, it is important to sample the first few inches of soil since it is this very top level of soil that might be inhaled.

Community Participation: In order to begin to effectively address the clean-up of our environment, the participation of affected communities must be institutionalized as part of the process. The blossoming of the fields of risk communication and comparative risk assessment are indications that the role of the general public is beginning to be taken seriously. Governmental agencies can no longer afford to make environmental clean-up decisions in a vacuum. In my community relations role, I have become convinced that community participation from the outset of a clean-up process generally enhances the process rather than impedes it. Participation of the community requires more than a rubber stamp to a government plan. It is also more than communicating bad news to the community in some type of palatable form. It is the establishment of a process whereby the community has a legitimate role that is clear to all parties. When government agencies pay no more than lip service to the community perspective and public participation, it often backfires at the end of the process, and the public rebels.

Multi-disciplinary Approach: A hazardous waste clean-up program must have a multi-disciplinary approach. The engineer with an understanding of various clean-up technologies must communicate with the toxicologist, the epidemiologist, the physician, the industrial hygienist, and the health educator/community relations person. Each specialist holds a piece of the puzzle but the puzzle can only be complete when there is communication and cooperation among all of the different disciplines.

Role of the Community Relations Coordinator: This person tries to facilitate some type of communication among groups who have very different perspectives. Each site is unique. I see myself as a health ombudsperson for the workers and residents around a site, but I am most effective in this advocacy role when I work cooperatively with all the other agencies and groups who have an interest in the site. I see myself as working in the middle of a group of dynamic force fields, as illustrated in Figure 1. My job is to strike some balance between all these different forces so that the health implications of the site are addressed consistently.

Figure 1: Community Relations Coordinator Role in Health Assessment Process at Hazardous Waste Sites



THE SCIENTIST AS PARTICIPANT IN ENVIRONMENTAL POLICY AND ACTION: EXPERIENCES OF AN AMERICAN SCIENTIST

Charles Weinstein
The Conte Institute for Environmental Health
Pittsfield, Massachusetts, USA

The Public Arena and the Role of the Scientist: As a scientist/educator, I operate in the public environmental "arena," primarily on a regional and local level. The word "arena" is, I believe, an appropriate one to describe the often competitive and confrontational setting in which scientists, the public, nongovernmental organizations (NGOs), government (at all levels), business, and industry meet. It is in this "public" arena that the reality of environmental policy and law is, to a significant degree, determined. It is also here that scientists have the opportunity to effectively communicate their position on environmental issues and, perhaps, have some impact on the development of policy.

I will present some personal examples of the scientist as educator and participant in the public discussion of environmental policy and the resolution of environmental issues. I have been fortunate to serve in a variety of roles in my region of the state of Massachusetts. As an educator, direct contact and interaction with the general public, students, government and its agencies, business, industry, NGOs, and the scientific community is the most important work that I do. As a scientist, I seek to translate scientific research into information that is meaningful and useful to others in the public arena. It should be no surprise that this task is not always successful.

The General Public: The word "public" is not completely accurate to describe this setting. Theoretically, everyone has access to this arena due to legal and policy mandates for public involvement, but it is not as open to public participation as it should be. Among the major obstacles to public involvement are a lack of education about the scientific issues and the resulting confusion and intimidation with the often complex reports and procedures involved. In this regard, scientists can play a vital role as educators if they participate actively in the public arena, where they can interact with the general public on some regular basis and establish a positive relationship with other concerned and involved citizens. The phrase "involved general public" includes people with a broad spectrum of educational and social backgrounds and a wide variety of intellectual, philosophical, and emotional motivations. We, as scientists, are included as citizens, and we must learn to listen to members of the general public without preconceived notions about their level of sophistication in issues of occupational and environmental health.

By being both a scientist/educator and an active citizen, I have come to be viewed as an information resource by people in my community and region. I have been contacted for this reason by other citizens and groups of citizens concerned about some environmental health issues, such as incinerator siting. In this role, I may act as a "translator" of complex scientific issues to the public as well as of public concerns to government and industry. I may also refer such inquiries to other, better informed scientists and thus function as a link between the general public and the scientific community. In some cases, I may make a public statement acting solely out of my concern that relevant and important scientific information be expressed in the public arena so that it is available to all interested parties.

Government and Quasi-Governmental Agencies: Government and its agencies operate in a complex web of policies and jurisdictions. The federal government operates at all levels of society through such laws as the Resource Conservation and Recovery Act and the "Superfund" legislation, which deal with hazardous waste clean-up, and the Clean Air, Clean Water, and Safe Drinking Water Acts. Many of these laws provide mechanisms for public participation, especially when a local site is involved. Unfortunately, the level of communication, cooperation, and trust is not always sufficient for the process to operate smoothly. Federal regulations may supersede state and local regulations, which are less rigorous—and may themselves be superseded when similar laws at the state level are more stringent, such as those on air quality standards or wetlands protection. This leads to regional inconsistencies, despite overall national policies that promote occupational and environmental health.

The local, municipal level provides perhaps the greatest opportunity for scientists (as citizens with expertise) to become involved in the development and implementation of environmental health policies. City councils often seek public participation through legally mandated or other appointed bodies, such as boards of health, planning boards, and conservation commissions. The Conservation Commission of Pittsfield, Massachusetts, for example, consists of locally appointed citizens (of which I am one) whose task is to enforce the state's Wetlands Protection Act at the local level. The members of this commission have considerable authority regarding the degree of enforcement and the effort they will make to protect critical resources, such as groundwater, that have a major impact on environmental health. The law specifically relieves the Commission of economic considerations in its enforcement, and other governmental bodies, such as the City Council, may view the Commission's activities as an "obstruction" to economic progress. However, the Commission is sensitive to these concerns and, whenever possible, imposes conditions on the activity of applicants that allow them to comply with the law without suffering unnecessary financial hardship. Scientists can play a key role in the ongoing struggle to balancing environmental protection and sustainable development with the pressures for short-term economic gain.

The master planning process is another opportunity for scientific input before environmentally damaging activities are undertaken. As an appointed member of the local committee working to develop a new master plan for the city of Pittsfield, I am able to take a proactive role in assuring better environmental conditions, such as a safe drinking water supply and open space, for the next generation. The general public has access and input to the process through a series of neighborhood meetings, their elected city councilors, and attendance at the Committee's meetings, which, according to law, are open to the public. As an environmental scientist, I have drawn the committee's attention to the need for remediation of industrially-contaminated sites, not only in consideration of public health but also because such sites will be unavailable for future industrial use if abandoned in a hazardous state.

I have also been involved in number of other governmental processes that require public participation, such as in the areas of environmental impact review (under the National Environmental Policy Act—NEPA, and the Massachusetts Environmental Policy Act—MEPA), transportation planning, and hazardous waste management. In each case, it is more effective to attempt to have an impact on public thinking and policy development early in the process rather than later when policies have been developed and activities have begun. Environmental impact studies generally proceed according to government guidelines. However, they require scientific oversight to ensure that the resulting study is not simply a report for its own sake but truly describes all relevant environmental impacts of a proposed project or policies. As an ecologist, I take a broad perspective in examining all potential environmental health impacts of proposed projects.

A frequently important role that I play in this part of the arena is in explaining uncertainties in the scientific data. Estimates of environmental impact and health risk are often based on the use of modeling techniques that yield projections. It is common for the public (and other participants in the arena) to attempt to distinguish among various projected outcomes based on such projections, even when the differences among them are statistically insignificant. Scientists must not only present relevant data and estimates in a meaningful way, but must also explain the degree of uncertainty involved in such estimates and their value for decision-making. Scientific "honesty" requires that scientists admit when they are unable to distinguish between the predicted impacts of two courses of action, based on currently available data.

Business and Industry: As with government, business and industry operate at all levels of society, but again it is at the local level where scientists participating in the democratic public process usually have the greatest impact. What may appear to be a scientifically "clear-cut" issue regarding the need to remediate a local hazardous waste site may, in the public arena, become a complex issue with a number of "sides." Environmental consulting firms hired by business and industry often point (justifiably) to the uncertainty of scientific evidence regarding the health consequences of pollution. Scientists working for business and industry, despite the obvious bias of their employers, represent an important source of scientific data and other information useful in the development of policies affecting occupational and environmental health. Their participation in the public arena should be viewed as a positive contribution to the process.

Meanwhile, local business interests, such as the "chamber of commerce," promote industrial growth and business development in the name of economic benefit, often with little understanding of the scientific issues involved. Local business groups are, however, often receptive to being educated about the public health considerations regarding certain types of business and industrial development. Rather than waiting to be invited, scientists can offer to speak on environmental health issues before a group of business people. Well-publicized "speakers' bureaus" are an effective way of gaining access to the meetings of business and industry.

As an example of cooperation among various economic interests, a large corporation and a consulting firm performing major risk assessment studies jointly sponsored my research on aspects of exposure assessment of contaminated soils. This was in response to my request to have more interaction with them in the public arena and to learn more about the risk assessment process, which is so vital to decision-making about hazardous waste site remediation. Their sole interest was to promote understanding of the risk assessment process through my participation as a better informed scientist in the public arena.

Nongovernmental Organizations (NGOs): As with government, business, and industry, nongovernmental organizations operate at all levels of society in promoting the public interest or, at least, the interest of their members. Like governmental bodies, these organizations represent their constituencies in a democratic manner and, therefore, are able to exert considerable influence on policy development and implementation, such as with citizens' complaints when law enforcement is inadequate. They include national and international organizations, such as the National Audubon Society and the Sierra Club, with hundreds of thousands of members, most of whom are members of the "general public." In addition, at this level, there are numerous scientific organizations whose focus is narrowed to a specific scientific profession. At the regional and local levels, NGOs may be chapters of national and international organizations, or independent groups that are either longstanding or ad hoc to address a specific, short-term issue. As a scientist/educator, I have participated, especially on a local level, in many of these organizations, both as a member and as a consultant (paid and unpaid) on specific issues.

For example, local watershed associations exist to promote, protect, and lobby on behalf of river resources in the public arena because they operate under the democratic premise that natural resources of a nation, to some degree, belong to the public. As a member of the board of directors and scientific advisor to such an association, I have been involved in a number of scientific and educational projects. They have included training citizens in water quality and biological monitoring techniques so they can collect baseline data that governmental agencies only collect when funding is sufficient (rarely) or when a serious pollution accident occurs. The active involvement of the public in scientific data collection and analysis, though on a very basic level, has been one of the most successful and rewarding efforts at helping the public to understand and support scientific work.

The watershed association, in cooperation with other governmental organizations and NGOs, has also published informational brochures on such topics as polychlorinated biphenyl (PCB) contamination of the river ecosystem and its implications for public health (such as fish consumption) in the area. Scientists can promote, by example, involvement in the public arena through NGOs that attempt to obtain legitimate scientific support for their positions so they can participate in a responsible and informed manner. Watershed association activities have attracted the attention of key governmental leaders and stimulated the development of river protection policies on a broad scale.

In conclusion, greater participation by scientists in the public arena is an effective way to promote communication and interaction between scientists and other segments of society and to gather support for scientific research. Though the public processes are flawed and the interactions are as frustrating as they are gratifying, to participate in policy development and implementation is the right and responsibility of all people of a democratic society.

CITIZEN EMPOWERMENT FOR ENVIRONMENTAL HEALTH: THE EXPERIENCE OF A COALITION OF NONGOVERNMENTAL ORGANIZATIONS IN THE UNITED STATES

Jim Tramel
Tennessee Environmental Council
Nashville, Tennessee, USA

I will describe a program of the Tennessee Environmental Council (TEC), a coalition of non-governmental organizations dedicated to (a) empowering ordinary citizens to participate in decisions concerning environmental health, and (b) focusing mobilized citizens on creating effective demands for environmentally sound policies by government and industry. At present, the TEC includes 62 member organizations, 2,200 individual members, and a staff of four. It is 22 years old, and conducts a number of programs, including the publication of a newsletter, a safe drinking water project, an energy initiative, and the toxics prevention project that I direct. Its resources derive from dues and foundation grants; it accepts no money from government.

TEC does its work in a context similar to that confronted by many Central and Eastern European countries. Tennessee is located in the American South, a historically underdeveloped region that has served as the dumping ground for two-thirds of all hazardous waste produced by American industry. In parallel to Central and Eastern Europe, southern states in the United States have competed with one another to attract capital by offering a low-wage, non-union economic climate. In the last two decades, this attempt to create a "pro-market" climate has also come to include weak or absent environmental regulations. Thus, Tennessee, which is 34th in population of America's 50 states, ranks second in industrial air pollution.

Southern state governments' policies of attracting industry at any price have created public policies and industry practices that afford more legal rights to industrial compounds than to the public's health. The goal of TEC's Toxics Prevention Project is to create a policy that emphasizes the prevention of pollution, rather than only meager attempts at its clean up.

Several key concepts underlie the work of this project:

- **Democracy:** the need to build institutions beyond our two-party electoral system that allow people to influence the decisions that shape their lives;
- **Empowerment:** the process of disseminating and demystifying knowledge so that citizens have access to scientific and public health expertise without being made subordinate to or dependent upon experts;
- **Constituencies:** the key first step towards preventive environmental health policies, identifying individuals and organizations whose interests provide common ground for action;

- **Leadership:** the enhancement of the ability of group members to act effectively in pursuit of group goals, developing their capacity to overcome learned dependency;

- **Coalition:** the coordination of activities among various, perhaps previously unconnected, constituencies for common purposes; and

- **Public Health:** as distinct from the domain of pure science, protection of public health calls for participation in the arena of policy-making, where decisions must sometimes be made on the basis of incomplete data.

Toxics Prevention Project initiatives are aimed both at the state legislature and at local industries. Several different avenues of action have been developed, some focused on education and empowerment, some on broad public information campaigns via newspaper and television outlets, some on negotiations with industry, and some directly on elected officials.

TEC has had success in presenting scientific information leading to action towards policy change in workshops with neighborhood, women's, labor, and African-American groups. Citizens are taught to use data from the federally-mandated Toxics Release Inventory (TRI), which details emissions by local industries onto community land and into community air and water, and the potential health effects of each compound emitted.

One of TEC's first steps in this campaign was to identify the most-affected constituencies, which led to building a coalition with African-American organizations. An American religious denomination, the United Church of Christ, has produced a report entitled *Toxic Wastes and Race in the United States,* which documents that the hazards of living near uncontrolled toxic waste disposal sites in the United States fall most heavily on African-Americans. In the United States, three of every five African-Americans live too near such sites. In Tennessee alone, this includes over 600,000 people.

With this firm factual basis, the TEC has established a working relationship with the Black Caucus within the state legislature, the Tennessee Black Health Care Commission, and Meharry Medical College (which was established for African-Americans). TEC has framed the failed current method of environmental regulation as a health—as well as an environmental—issue. One early success of this strategy has been the creation of a legislative study committee on environment and public health—the first time in Tennessee's history that elected officials are examining diseases associated with environmental exposures.

TEC is working to build similar alliances with (a) labor unions concerning industrial exposures, and (b) rural and women's organizations concerning the hazards posed by toxic emissions. One successful strategy has been to bypass the weak regulatory structure, and to focus campaigns directly at unnecessarily hazardous industries.

A small organization in western Tennessee has demonstrated that citizens are capable of protecting themselves. The "People of Woodstock," a small town, have successfully pressured the DuPont Company, a large United States chemical manufacturer, to sign a "good neighbor agreement." DuPont agreed to decrease its emissions of toxic air pollutants, as defined by the TRI listing, from the local plant by a full 90 percent by 1994. This agreement also demonstrated that jobs need not be lost and that safer substitute compounds and engineering processes are available to this manufacturer. The economic development of this area of Tennessee will not be negatively affected, but environmental health will be improved.

These components of TEC's work—identification of most-affected constituencies, education towards empowerment, coalition-building, and negotiation and lobbying by large numbers of citizens—have led to early successes in moving Tennessee towards a preventive health policy of toxics use reduction. The historical legacy of Tennessee's economic underdevelopment—and associated health problems—can serve as a case study for those environmental health advocates in Central and Eastern Europe who know that public health is ill-served by unquestioning and unregulated pro-market economic policies.

Dr. Henryk Kirschner and Dr. Mykola Prodanchuk sing folk songs played by an accordionist at an evening picnic.

WORKSHOP ON POLICY AND ACTION IN A DEMOCRACY

led by
Eve Spangler
Boston College
Chestnut Hill, Massachusetts, USA

John Wooding
University of Massachusetts Lowell
Lowell, Massachusetts, USA

The countries of Central and Eastern Europe have moved rapidly to replace Soviet-style communist systems with free-market economies and liberal-democratic forms of government. The rate and extent to which this transformation is taking place vary by country and so do the specific economic, social, and political conditions that structure each policy. There is, however, an overall common theme beginning to emerge: that "democracy" in some shape or form should structure the relations between State institutions and the citizenry. How this is to be achieved and what it might look like in each country remains to be seen. The assumption, prevalent in free-market economies, is that the market mechanism provides a foundation for the construction of just and equitable institutions and associations that, in turn, protect the liberty and welfare of citizens. Some form of this assumption now strongly influences the politics of the countries of the former Soviet bloc.

We began this workshop with some questions about the validity of this claim, and we suggested that "democracy" may not automatically be guaranteed by the market. Our central concern is that democratic ideas and the actualization of the democratic impulse cannot be legislated, cannot be given to the public from "above." Rather, it must be struggled for, learned about, and practiced in a number of related and meaningful ways.

The problems of environmental and occupational health, the protection of workers and the environment, illustrate the nature of democratic action in very practical terms: how can citizen participation protect worker health? How can public comment control and prevent environmental degradation? What are the mechanisms that best ensure that public policy in this area reflects and respects the needs of those most directly affected? These are vital questions that must be addressed if the scientific and technical knowledge available to practitioners of environmental and occupational health are to play a meaningful role in improving the welfare of workers and community residents. In short, we began this workshop seeking to explore how science might meaningfully translate into policy and action.

Our goal was to illustrate the problem of making democracy work. We sought to provide a context in which the idea of citizen action to protect workers and the environment would be played out in the United States. We wanted to suggest that democratic control over these issues in a liberal democracy is bounded and constrained by a number of interrelated variables, not necessarily obvious to those who view liberal democracy as being an automatic consequence of the free market. In particular, we sought to show that differentials in economic and political power, access to resources (both material and social), and social and political influence would affect the overall outcome and shape of public policy.

To reach these goals we conducted an extensive role play that, as far as was practicable, mirrored an archetypal public hearing in the United States. We designed this activity so that the forces, actors, and coalitions typical to these types of issues could be played out in a simulated town hearing. The theme of this role play was a discussion about the opening of a proposed lead reclamation plant in Pultusk, Poland.

We used this scenario as a vehicle for mapping out and identifying the potential actors; their bases of support; and their access to material, political, and ideological resources, reflecting a similar set of issues typical of this form of debate in the United States. Our purpose was to seek to illustrate seemingly objective technical issues: the health threat posed by the plant, scientific knowledge as evidence in the evaluation of that threat, the economic impact of the plant's operation, and the social impact of its being established, mediated by a political process that distorts, interprets, and reifies scientific knowledge. In short, we sought to show how seemingly technical problems confront political reality in a liberal democracy. Our goal, therefore, was to get the symposium participants to gain practical experience in translating the knowledge held by professionals into actions that would provide information for citizen control over policies that have direct implications for workers and the environment.

THE CASE

The Kosciusko Battery Company is a manufacturer of lead batteries and employs approximately 400 people in its Pultusk plant. Pultusk is a small rural town, and Kosciusko is its only major manufacturing facility. The plant was started under the 5-year plan of 1950 and expanded thereafter, but without significant capital upgrading. In 1990 it was bought by Worldwide Electrical Company (WEC), an American multinational, as part of a deal in which WEC also acquired plants in Romania and Bulgaria.

In January, WEC announced plans to expand the Kosciusko plant to include a battery reclamation facility. WEC has requested permission for the necessary construction from the Provincial Planning Commission, expecting quick approval. In addition to providing 150 new jobs, WEC has offered to finance the electrical systems for the new Pultusk Community Center and to upgrade the electrical system at the Pultusk Community Hospital. The new battery reclamation facility would be located upstream from and quite near to the Pultusk Primary School.

The local plant manager, Tadeusz Gancarski, was the deputy plant manager under the Communist regime, and was promoted to general manager during the Masowiecki government, when the old plant manager retired. Gancarski lives locally and has recently added a new wing to his house, which was once the family farm near town. He has good relations with local community government and religious leaders, and with the emerging merchant group of the town. On the whole, his relations with the leaders of the established Polish Metallurgy Workers Union are also amicable. The political affiliations of the local plant management team are mixed: some have recently joined the new Christian Democratic Party; some have found a home in the Farmer's Party, a frequent coalition partner of the Christian Democrats; and a substantial number have joined the Free Democracy Party, which draws most of its members from the former Communist Party. Local managers naturally favor plans for expansion.

Employees of the Kosciusko plant live in and around the town of Pultusk. They are represented by the Polish Metallurgy Workers Union (PMWU), a group that grew directly out of the union that functioned within this plant during the Communist regime. The president of the local union, Janus Grotnik, has worked in the plant since 1965 and is well respected despite the union's acquiescence, during the WEC buyout, to job redesign and speedups. The PMWU has endorsed Social Democrat candidates in all the primaries and elections since the overturn of the Communist regime. The PMWU favors plant expansion and insists that workers previously laid off be the first ones to be hired.

Recently, an insurgent group, the Workers for Democracy, has begun an organizing drive in an attempt to challenge the PMWU. Istvan Lubetsky, the leader of the Workers for Democracy, is a shop steward and much younger than Grotnik. The insurgents have based their organizing campaign on the issues of resisting layoffs and cutbacks in worker health benefits. In addition, Istvan Lubetsky suffers from elevated blood lead levels, which he discovered at a screening sponsored by HealthFAIR, during a family visit to the capital. Members of the Workers for Democracy are thought to vote for the newly formed Young Democrats party, but this alliance has not yet been tested at the polls. The Workers for Democracy are calling for joint labor-management committees to control all aspects of work at Kosciusko Battery and are wiling to oppose plant expansion until such a joint committee structure has been accepted.

Some opposition has unexpectedly developed in the town. In an effort to forestall later demonstrations, the chairperson of the Provincial Planning Commission and the mayor of the town have decided to hold a public hearing on the matter before proceeding. People who wish to be heard at the hearing have been asked to notify the Commission in advance of their intention to speak. Speakers will be limited to maximum 10-minute presentations.

Three people are key to the town-based opposition. Dr. Michael Niedzwicki, the local general practitioner at the Pultusk Free Clinic, has been treating two workers from the plant who have elevated blood lead levels, and he has seen several lead-exposed children, at least three of whom are children of Kosciusko workers. He has requested permission to address the Commission at the public hearing. He is a member of the Young Democrats.

Mrs. Danuta Kosinski, the president of the local chapter of Parents of Schoolchildren, has also indicated that she will speak at the Planning Commission hearings. She is alarmed by the proximity of the projected reclamation facility to the school. Parents of Schoolchildren is not affiliated with any political party.

Dr. Henryk Pfeffer, the leader of the local Hanseatic Friendship Society (normally a group that sponsors cultural events to promote Polish-German friendship), has asked to address the Commission about the proximity of the plant to the German section of Pultusk, which lies just beyond the school grounds. Members of the German community are also concerned over the fact that they are assigned a disproportionate number of the jobs with the highest risks of lead exposure. Members of the German minority in Pultusk have generally voted against the dominant Social Democratic Party and are thus found in the ranks of the Christian Democrats.

A surprisingly large number of other individuals and spokespersons have indicated their intention to address the Planning Commission. These include:

Representatives of both the Polish Metallurgy Workers Union (Mr. Grotnik) and the Workers for Democracy (Mr. Lubetsky).

Tadeusz Gancarski will represent the plant. He has indicated his intention to bring with him Dr. Ladislaw Osofsky, the plant physician, and Dr. Ivan Kozaczka, the industrial hygienist who heads the Joint Labor-Management Plant Safety Committee. (Dr. Kozaczka is also a member of the Polish Plant Safety Society which has recently issued stringent new guidelines warning that even very low levels of lead exposure can produce serious health problems.)

The Polish Ecological Club (PEC) will be sending Mr. Andreas Medlinsky to the hearings. In Pultusk, the PEC has members drawn from the medical community, the insurgents union, and the Parents of Schoolchildren. One of the newly elected City Councilors is also a member. In general, PEC members are thought to vote for the Young Democrats.

The Greater Pultusk Chamber of Commerce will be represented by Marek Matszynski, the owner of the new local pharmacy and leader among small merchants. Chamber of Commerce members are Christian Democrats.

The City Council has indicated its intention to send a representative, although the identity of the speaker remains in question. Internal divisions within the Council, among councilors identified with labor, with business, and with the ecological movement, have made it difficult to name a representative.

Several national ministries will also be represented. These include the Ministry of Labor, the Ministry of the Environment, and the Ministry of Economic Development. It is known that the three ministries advocate different standards of plant and environmental safety.

The Polish Broadcasting System will send a reporter, Halina Dobzhansky, to cover the hearing. She has indicated to the Commission her intention to spend two days in Pultusk, gathering background information while attending the hearings. She has invited contacts from local groups.

Notably absent from the meeting is a representative of WEC, but WEC has made available to Mr. Gancarski and the local plant management team its considerable resources for producing a five-minute video and press kit to be used at the hearing. WEC has also shared with Mr. Gancarski its contingency plans for developing the battery reclamation facility in its Bulgarian affiliate if the Provincial Planning Commission does not quickly grant building permission.

The meeting will be held in the evening, so all citizens can attend. The Commission must make a decision within a week after the meeting. The following groups will shape events at the Commission hearing:

- Kosciusko Battery Plant - Tadeusz Gancarski, Dr. Ladislaw Osofsky, Dr. Ivan Koczaczka and associates

- Worldwide Electrical Company

- Polish Plant Safety Society (member, International Congress of Industrial Hygiene) - Dr. Ivan Koczaczka

- Polish Metallurgy Workers Union - Janus Grotnik

- Workers for Democracy - Istvan Lubetsky

- Pultusk Free Clinic - Dr. Michael Niedzwicki

- Parents of Schoolchildren - Ms. Danuta Kosinski

- Hanseatic Friendship League - Dr. Henryk Pfeffer

- Polish Ecological Club - Andreas Medlinsky

- Pultusk City Council

- Greater Pultusk Chamber of Commerce - Marek Matszynski

- Ministry of Labor; Ministry of Economic Development; Ministry of the Environment

- Polish Broadcasting Corporation - Halina Dobzhansky

DISCUSSION

We began this role play by raising some of the issues discussed above. Participants were divided into several groups representing the actors whose roles would be important in a town hearing concerning the placement of a lead battery reclamation plant. These included: representatives of the multinational corporation that now owns the plant and plans its expansion as a reclamation facility; local plant managers; workers represented by both established and insurgent union leaders; political officials; environmental groups; the plant physician and industrial hygienist; the town doctor and community representatives; and the parents who fear adverse health effects in their children due to the lead facility. These groups were supplemented by representatives of the media and by individuals from national ministries.

The context of this discussion explicitly posed the question of the tension between economic benefits of the factory (investment, jobs, income, and stimulation of the local economy) and the possibility of damage to the health of plant workers, community representatives, and the local environment. It was also suggested that such meetings in the United States, while providing a legitimate arena for citizen participation, also function as "symbolic" politics, channeling discontent and thereby containing, defusing, and legitimizing democratic participation.

Participants, all of whom had an opportunity to review the case beforehand, were given an hour to meet as separate groups to plan their presentations to the hearing and to discuss their strategies. Each group was asked to address the following specific questions:

- Goals/positions for its appearance at the Provincial Planning Commission hearing
- Tactics for achieving its goals
- Tactics for dealing with the media to promote its goals
- Resources (material, intellectual, and cultural) that could be mobilized to attain goals
- Likely allies among the other groups; resources and strategies for forging an effective coalition with potential allies
- Identification of opponent groups; analysis of opponents' likely strategies, potential allies, strengths, and weaknesses; plans to counter the opposition

The role play proved to be a popular and effective way to raise the issue of translating science into policy and action. Participants were enthusiastic and involved in the discussion and were very effective in presenting their designated positions at the planning meeting. We feel that the overall effect of this discussion achieved some measure of verisimilitude and reflected, as far as possible, what might have happened in the United States. There were, however, some interesting and illuminating differences.

During preparatory discussions, the individual groups planned their positions very effectively but showed little awareness of the need to make permanent or temporary alliances with other groups. One of the most important and effective strategies for achieving specific political goals in a democracy is to ally with other groups who have similar agendas or who can perceive benefits from common action. For example, the linking of workers in a plant with environmentalists and concerned community members in order to fight the threat of toxic contamination from an industrial plant is an effective (though often difficult) alliance. Similarly, community groups and unions in the United States seek out the advice and help of professionals to gain information about specific issues and to provide scientific legitimacy. In the role play, the Central and Eastern European participants rarely used an alliance strategy. This meant that they fought each other in discussion and were not in a position to provide mutual support in the areas of common interest.

The various groups in the role play were very successful in stating their position and playing out what might be termed their "interests." In only a few cases, however, did these groups appear to have a well thought out and comprehensive strategy. Most of the participants clearly knew on which "side" they were fighting, but their arguments rarely went beyond the immediate goal of presenting their positions at the town planning meeting. In short, they had no long-term strategy. This is important to the success of political action in a democracy because long-term planning provides a solid base for organizing any community of individuals. Without such planning and the articulation of specific goals in the process, many activist groups are unable to retain the strength of their coalition beyond the immediate cause. As a result, the group quickly disintegrates.

In our experience in the United States, the absence of a conscious effort to find allies can seriously weaken the effectiveness of groups fighting institutions with greater economic and political power, such as large corporations or government agencies. Similarly, failure to establish

Participants prepare for role play.

a long-term set of goals and a strategy for reaching them is often fatal to the effectiveness of lobbying efforts. Groups fighting potential occupational and environmental hazards from inside and outside an industrial facility need to know very concretely who their friends might be and what their long-term goals should be.

We believe that role plays such as the one done at this symposium are a very effective means by which to raise issues and elaborate important themes. In this case, we tried to show, by replicating a town planning meeting, what political action may mean in a democracy. We hoped to show that translating knowledge into policy and action confronts a political, rather than technical, problem. We emphasized throughout the scenario that the creation of policy in free-market liberal democracies is bounded by the political and economic power of the major actors. In most cases, these actors will be able to set the agenda of discussion and effectively prevent challenges to their goals. Less powerful groups in society (typically community members and workers) will be forced to form alliances, be specific about their goals, and work assiduously to gain the necessary technical information from reputable sources.

What this suggests is that further role plays must seek to explore in more detail the role of policy in general and the specific contribution made by scientific professionals in protecting occupational and environmental health.

Dr. Daniela Pelclova and Dr. Jaroslav Volf comfort their "babies" during role play.

IMPROVING LINKAGES BETWEEN NONGOVERNMENTAL ORGANIZATIONS AND SCIENTISTS AND THEIR ORGANIZATIONS

Ondrej Velek
Czecho-Slovak Society for the Environment
and National Institute of Public Health
Prague, Czech Republic

There is an important need in the Czech Republic and other countries in Central and Eastern Europe for nongovernmental organizations (NGOs) to draw upon and utilize the expertise and experience of scientists and organizations of scientists. While there have been no official links thus far in the Czech Republic between environmental ("green") nongovernmental organizations and organizations of scientists, a number of scientists have been actively collaborating with nongovernmental organizations, often providing these organizations with advice and consultation.

NGOs have important roles to play with regard to environmental issues, including environmental health. These roles range from advocating for the passage of new laws and regulations on such matters as the community's right to know about toxic materials in the environment to pressuring government for strong enforcement of existing laws and regulations. In many of these roles, input from scientists can help to provide needed guidance, to focus on priority concerns, to provide needed background information and documentation, and to mobilize governmental decision makers and the general public behind a particular issue.

NGOs must think globally and act locally. In order to be highly effective in both their thinking and their actions, they must identify and utilize scientists and organizations of scientists, and, at the same time, not to lose their missionary role in changing systems of social values (freedom, equity, and well-being) towards sustainable life.

The Green Circle promotes coordination of and communication among environmental NGOs in the Czech and Slovak Republics. The Czecho-Slovak Society for Environment was established in 1990 as a federal NGO, gathering mostly Green-oriented experts from different branches of science, industry, politics, education, and media. Activities of these societies are based on a complex approach to the natural and man-made environment that is envisioned as a network of open, dynamic, and hierarchic systems in permanent interaction. They focus on the urban environment, the natural environment, waste disposal, landscape transformed by human activity, environmental toxicology, environmental economics, environmental legislation, environmental health, ecological education, and environmental information systems.

The Green Parliament was dismissed by the Ministry of Environment in the autumn of 1992. The new Society for Sustainable Development, established then, is now the most respected and active environmental scientific NGO.

MAJOR ENVIRONMENTAL NONGOVERNMENTAL ORGANIZATIONS

Green Circle Office
Lublaňska 18
12000 Prague 2

Telephone:	42-2-296048
E-mail:	HAISOVA.MARIE@ECN.GN.APC.ORG

Society for Sustainable Development
Dipl. Ing. Josef Vavrousek, Ph.D., Chairman
Pricna 1
120 00 Prague 2
Czech Republic

Telephone/Fax:	42-2-206191
E-mail:	DLOUHY.JIRI@ECN.GN.APC.ORG

Czecho-Slovak Society for Environment
Ondrej Velek
V Nasypv 3
152 00 Prague 5
Czech Republic

Telephone:	42-2-534939
Fax:	42-2-733113
E-mail:	VELEK.ONDREJ@ECN.GN.APC.ORG

SCIENTISTS AND CITIZENS IN SEARCH OF NEW SOLUTIONS

Charles Levenstein
University of Massachusetts Lowell
Lowell, Massachusetts, USA

The overriding public health problems of our times are rooted in the workplace and in the environment. As we move toward the year 2000, the problems grow. And the issues involved in working for occupational and environmental health also grow more complex, more sophisticated, more difficult to sort out. There are many voices contributing to the debate: lay and professional, scientific and medical, political and economic.

A public health movement is gathering strength among working people in Poland and among citizen activists in communities everywhere, among ordinary people who are trying to defend themselves from the technological hazards that seem inbred in our society. The list of hazards they have taken on is a long one, and no doubt an unfinished one. It ranges from asbestos in workplaces and schools, to lead in paint, reproductive hazards at work, and toxic wastes poisoning our water, our air, and even our homes.

Too frequently, however, scientists and public health professionals dealing with these problems view the citizen activists and trade unionists who have been stirred to action as barbarians or hysterics who get in the way of "good science." Professionals miss great opportunities to educate and, equally as important, to learn from this public health movement. They miss chances to collaborate and work cooperatively with that movement. And perhaps they do not appreciate that almost invariably the solutions to environmental problems will be political ones, and that the size of the constituency behind an issue is a force to be reckoned with.

In the United States, we have created *New Solutions*, a journal which we hope will become a bridge between scientists and community leaders, between public health professionals and labor activists, between the people affected by a problem and those whose job it is to study and resolve it.

The mission of the journal illustrates important ways in which science and citizenry can interact to open up the debate and discussion of public health action. We need to examine the leading edge of occupational and environmental health policy, translate it into terms intelligible to lay people, and analyze the results of recommendations and of inaction. It is necessary to look at the history that has brought us to this point, and to try to interpret it so that we can go farther.

All articles submitted for *New Solutions* are subject to peer review. Reviewers ensure scientific merit, and at least one is selected to consider readability for the lay audience. A wide range of editorial consultants has been recruited for this task. Further, a distinguished editorial board has been assembled to ensure that *New Solutions* is in touch with key debates and other issues in occupational and environmental health.

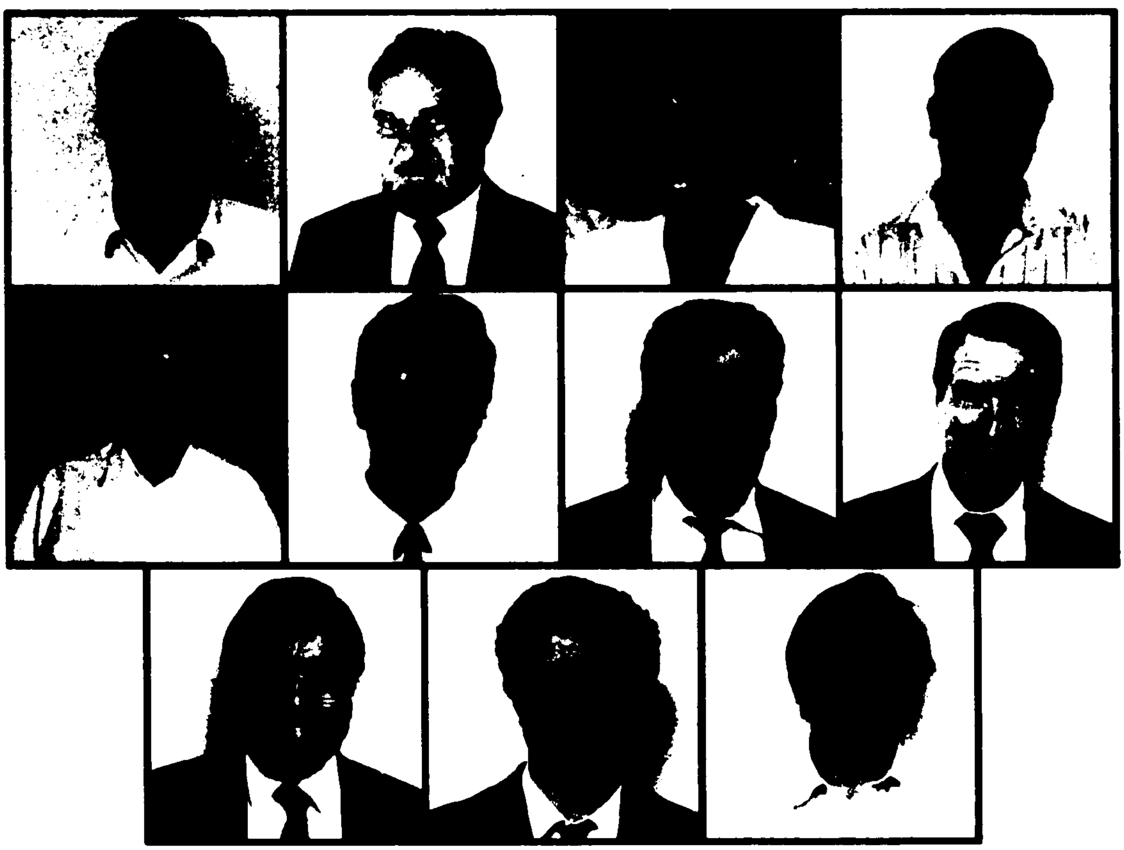
The sections of the journal are indicative of the way in which scientists and activists can support each other in their mutual endeavors. For instance, "Scientific Solutions" covers the current state of scientific knowledge, the research agenda, and proposals for solving key environmental and occupational health problems. "Engineering Solutions," edited by a ventilation engineer and industrial hygiene professor, reviews new technical approaches. On the other hand, "Movement Solutions," another regular section, focuses on grassroots movement activities, including campaigns by Coalitions for Occupational Safety and Health (COSH groups) from throughout the United States. "Voices," a section of the journal edited by an oral historian, uses interview techniques to capture the experience and attitudes of activists who are unlikely to write for a journal but who must be heard in the policy debate.

Of course, no open forum for debate would live up to its mission without accepting comment, criticism, and other points of view. Accordingly, we have a regular section called "Comments & Controversies," where we spotlight the options of our readers on issues addressed in the journal.

Perhaps the creation of such a forum in Central and Eastern Europe — in which scientists, activists, and concerned citizens could learn about each other and debate issues — would be a major contribution to the emerging "civil societies" as well as to environmental problem-solving.

PART THREE: METHODS AND APPLICATIONS

SECTION SIX: METHODOLOGICAL APPROACHES



Top row: Peter Rudnai, Holger Hansen, Barbara Gerwel, and Kenneth A. Mundt.
Middle row: Jerzy A. Sokal, Paweł Gorynski, Jerome J. Wesolowski, and Joseph LaDou.
Bottom row: Carl F. Cranor, Davor Lovincic, and Janusz Świątczak.
Not Pictured: Janusz Bajsarowicz (see photograph on page 208).

USE OF ENVIRONMENTAL EPIDEMIOLOGY IN PUBLIC HEALTH PRACTICE: A METHODOLOGY TO TRANSLATE SCIENCE INTO POLICY AND ACTION

Peter Rudnai
"Béla Johan" National Institute of Hygiene
Budapest, Hungary

There has been an increasing awareness of the environmental hazards to human health all over the world. Environmental pollutants are generally present in the air, water, soil, or in food in relatively small concentrations that usually do not produce acute health effects. Nevertheless, even if in small quantities, they are present in the environment for a long time—in many cases as long as a lifetime.

On the other hand, the sensitivity and the vulnerability of the people to environmental factors and the type and strength of biological responses evoked by these factors can be very different in different people, depending on their age, gender, physical and mental health status, nutrition, social and economic status, lifestyle, and other factors. Therefore, it is difficult to draw conclusions on possible health effects of environmental hazards on the basis of health effects found in particular individuals. So we have to rely on epidemiologic studies to find associations between exposures (at different levels) and health effects. Results of these studies can be interpreted only at the level of populations, not individuals.

In everyday public health practice, the following questions often arise:

- What kind of health effects may occur as a result of environmental pollution from a specific source?
- What are the hygienic limit values, above which adverse health effects can be expected or below which there is no serious concern about adverse health effects?
- How high is the health risk if the exposure exceeds the permitted level?
- As financial resources are limited, what priorities should be set for actions in order to eliminate or prevent further exposure responsible for the most serious health consequences?
- What benefits can be achieved by various remedial actions, and at what costs?
- How effective have the remedial actions been in decreasing the danger to health created by the excessive exposure?

These questions can be answered by the so-called "agent-oriented," or "factor-oriented," epidemiologic studies, in which possible health effects (mortality, acute and chronic morbidity, and functional impairments) are considered, and the frequencies and distribution of health effects among the exposed and control populations are compared and examined for dose-response or dose-effect relationships.

adverse effects of environmental hazards. The strategies serving this goal are: (1) early recognition of problems; and (2) control and prevention.

What tools do we need to fulfill these strategies? We need: collection, evaluation, appropriate presentation, and timely dissemination of data. For most actions needed, such as developing and implementing regulations, the public health service has limited means. The main roles have to be played by other organizations and governmental bodies. Nevertheless, the public health service has very important responsibilities to provide these bodies with appropriate information, to keep the public informed, and to promote public support of an environmentally conscious and healthful way of life. Evaluation of effectiveness is an important tool of public health policy and must be done.

My conclusion is that environmental epidemiologic surveillance can be the most appropriate tool in public health policy. We must make every effort to establish good national environmental epidemiologic surveillance systems which can, and should, be linked with an international network for such surveillance.

Discussion group at symposium.

THE ROLE OF EPIDEMIOLOGIC EVIDENCE IN POLICY-MAKING

Holger Hansen
University of Connecticut School of Medicine
Farmington, Connecticut, USA

On September 8, 1849, the handle of the Broad Street pump in London's Golden Square was removed on an order of the Board of Guardians of the local parish. The previous day, Dr. John Snow, an epidemiologist by vocation, had presented persuasive evidence to the board. His account of the 83 deaths from cholera that had occurred in the vicinity a week earlier implicated the pump as the source of this explosive outbreak. In addition, he argued, "There is no other circumstance which offers any explanation at all, whatever hypothesis of the nature and cause of the malady be adopted." However, the impact of closing the pump is uncertain: the epidemic had peaked by the time the action was taken.

This event from the early annals of epidemiology illustrates several problems that arise in the interphase of epidemiologic evidence and policy-making. Evidence may be incomplete in crucial ways (no causative agent of cholera was known at the time); its validity may be contested (many of Snow's contemporaries rejected his ideas of cholera transmission); and it may represent reasoning by elimination rather than proof positive (Snow's refutation of competing explanations probably was more convincing than the evidence in support of his own).

To explore the relationship of evidence and policy in health in greater detail, I will discuss the conflicting nature of science and policy, reasons why it is particularly difficult for epidemiologic evidence to influence health-related policy, and suggestions for lowering some barriers that impede a productive relationship of epidemiologic evidence and policy-making.

The scientific process, which generates evidence, and the political process, which establishes policy, have little in common. Different forces drive them. They view each other with disdain, if not mistrust. The scientist who enters the policy domain is seen as something less than a scholar, and the policy-maker who looks for scientific evidence may be perceived as indecisive. The philosophy, or ethic, of science and that of policy-making are diametrically opposed. Science thrives on ambiguity, whereas policy-making seeks certainty. These tendencies clash, for example, in legislative hearings, where scientists, aware of the limitations of their enterprise, offer qualifiers and disclaimers, to the frustration of legislators who want "the facts."

The other major difference exists in the way that science and policy-making are conducted. Science operates largely in a closed environment, shielded from public view. Scientific controversies tend to be played out in settings and in language that are beyond the reach of the rest of society. In contrast, policy-making is a more open process, although the degree of openness varies obviously with the given sociopolitical system.

Finally, social significance, or impact, sets science and policy apart. Scientific knowledge, per se, has little effect on society. Although scientists may regret this, it allows them to make errors without much penalty. It is only through policy that science impacts upon society. Obviously, policy has the potential to do much good as well as much harm.

The discordant nature of science and policy is reflected in their different approaches to problem-solving. The factors that enter into solving scientific problems, such as study results, tend to be objective. They are subject to verification. Policy, on the other hand, is shaped to a considerable degree by subjective factors, such as cultural values, ideology, and religion.

Next, the processes by which these factors operate are quite distinct. Scientific evidence tends to reflect broad consensus, shaped by the predominant findings of scientific inquiry. In contrast, policy-making tends to be an exercise in compromise, where conflicting interests pursue self-serving goals. Scientific logic has limited chances to succeed in the policy battle of self-interests. Results of scientific problem-solving are always tentative since knowledge gain is an ongoing process. Scientific evidence is constantly modified, reinforced, or discarded. Scientific problem-solving moves in relative terms, but policy, almost by definition, proceeds in absolutes. A change of evidence comes more easily than a change of policy. The obstacles science and policy face in forming a partnership are aggravated by special characteristics of policy-making related to health and by the nature of epidemiologic evidence.

Both explicit health policy and policy that affects health implicitly touch on many sectors of society. Thus, diverse forces compete for influence. Economic interests are at stake, cultural values are protected, professional hegemony is promoted, and personal welfare is defended, to name a few. Not only does health-related policy-making involve diverse forces, but these forces often hold distinctly adversarial positions.

Conflict resolution in the health field is particularly troublesome, in my view. Health does not have a strong lobby in any social system. Consequently, health interests are likely to be overwhelmed by more powerful interests. At best, society adopts a double standard. In the former Soviet Union, the government placed advertisements side by side: one to boost the sale of certain brands of cigarettes and the other to warn of the dangers of smoking. One branch of the United States Government supports tobacco growers while another conducts a national anti-smoking campaign.

Then, there is the issue of consequences. Health policy can have a dramatic impact on society, positive as well as negative. And there are true dilemmas where, for example, health protection comes at the expense of economic development and vice versa. Another example of serious policy consequences is the violation of privacy that is a necessary part of communicable disease control.

There are certain features of epidemiologic research that may compromise its value for policy-making: epidemiology addresses only parts of what are multifaceted problems, it tends to use observational rather than experimental strategies, and its findings have greater validity for population groups than for individual group members.

Health of populations is determined by a multiplicity of factors, many of which are outside the domain of epidemiologic study. Furthermore, those that are subject to epidemiologic inquiry are rarely addressed comprehensively. On many major health issues there are considerable gaps of knowledge. Thus, epidemiology contributes only part of the information base that policy-makers need.

Most epidemiologic evidence is derived from nonexperimental investigations. Even though a strong observational study may take advantage of a semi-experimental situation, it lacks the persuasiveness of a rigorously controlled experiment. Consequently, epidemiologic evidence often is distorted by bias and other confounders. The strength of epidemiologic research derives largely from the fact that it is population-based and from the consistency and coherence of its findings.

The population orientation of epidemiology gives rise to another problem. Epidemiologic evidence describes the average experience of a group, which cloaks individual variability. For example, improved survival following a new treatment is a group phenomenon, with some members benefitting little and others gaining much. Similarly, individual susceptibility to environmental and occupational hazards varies considerably. Traditional methods of epidemiology are not suited to predict individual susceptibility accurately. However, the growing use of biomarkers in epidemiologic studies will improve predictive power.

This discussion has dealt with generic contrasts that make it difficult for epidemiologic evidence and policy-making to come together in a fruitful relationship. Yet, epidemiologists want their findings to translate into policy, and health policy-makers seek epidemiologic evidence. There are barriers that needlessly widen the gap between the two groups. They come down to understanding and communication.

Each side needs to understand better how the other side operates. Epidemiologists need to develop an appreciation of the policy-making process. This can be accomplished best by involvement in the process, something epidemiologists should pursue actively. Policy-makers need to develop a better understanding of the nature of epidemiologic evidence. Understanding can be nurtured through discussions and workshops with epidemiologists.

Finally, we come to the issue of communication. Epidemiologists converse in their own jargon. It is essential that epidemiologic evidence be conveyed and interpreted in terms that are meaningful to policy-makers and the general public. John Snow carefully studied a pressing health problem, involved himself proactively in policy-making, explained his findings in accessible terms, and brought about action. Today's John Snows should do no less.

OCCUPATIONAL LEAD SURVEILLANCE IN NEW JERSEY, 1985-1991

Barbara Gerwel
New Jersey Department of Health
Trenton, New Jersey, USA

Lead is the most widely used nonferrous metal; more than one million tons are used annually in the United States. Roughly one half is used in manufacturing of storage batteries and battery oxides; one quarter is used in other metal products such as ammunition, bronze, brass, cable covering, solder, pipes, and lead metal sheeting; and one quarter is used in pigments and gasoline anti-knock products. The United States National Occupational Exposure Survey (NOES), conducted between 1981 and 1983, estimated that almost 1.4 million workers were exposed to lead. The major environmental sources of lead exposure are paint and lead contamination of food, soil, and water. Children and other family members are exposed to lead dust transported into homes on workers' clothing. Lead exposure in general industry is regulated by the United States Occupational Safety and Health Administration (OSHA). The construction industry, where significant exposures to lead have been documented, is exempted from this standard.

The most important route of absorption from lead in the workplace is inhalation of lead oxide fumes or fine lead particles. Gastrointestinal absorption of lead may be significant in occupational settings where poor hygiene is practiced. Occupational lead exposure adversely affects the nervous, hematologic, renal, cardiovascular, gastrointestinal, and reproductive systems. At present, blood lead level (BLL) is the best available indicator of current lead absorption or dose.

In order to assess the magnitude of the occupational lead exposure problem in New Jersey, the state health department developed two regulations requiring reporting of lead toxicity. The first regulation, which went into effect in 1985, requires clinical laboratories to report BLLs equal to or greater than 25 µg/dl to the department. The second reporting requirement, a regulation requiring physician reporting of lead poisoning, went into effect in 1990. An active surveillance program for occupational lead toxicity has been built on these reporting regulations. The goal of the surveillance program is to eliminate exposures that result in workers having BLL concentrations greater than 25 µg/dl. Components of the surveillance program developed between 1985 and the present include: the collection and computerization of case reports; follow-up interview of and medical consultations to affected individuals and their physicians; industrial hygiene evaluations at workplaces identified as sources of exposure; referrals of selected workplaces identified from BLL reports to OSHA for enforcement of provisions in the federal lead standard; and educational mailings to affected individuals, their employers, and physicians.

Between 1985 and 1991 the department received 16,674 reports of BLL 25 µg/dl or higher for 3,643 individuals. Thirty-two percent of reported individuals had a BLL of 40 µg/dl or greater, a level suggested as requiring medical evaluation. Fourteen percent had a BLL of 50 µg/dl or greater, an average level at which OSHA requires a transfer to an unexposed job. Three percent reached a BLL of 70 µg/dl or greater, which frequently requires medical treatment and

WORKPLACE-BASED SURVEILLANCE AS A STRATEGY FOR POLICY DEVELOPMENT AND DISEASE PREVENTION

Kenneth A. Mundt
University of Massachusetts School of Public Health
Amherst, Massachusetts, USA

Epidemiological surveillance in occupational settings can be used as part of a larger strategy for protecting workers, by identifying areas for intervention and by providing objective evidence for basing policy decisions that lead to occupational disease prevention. The value of surveillance-related activities has been recognized for centuries. Well-accepted benefits of surveillance include early detection of disease in order to stop its progression and improve the chances of successful medical treatment, and identification of possible preventive actions. For example, identification of a case of occupational lead poisoning through workplace surveillance might lead to appropriate medical management of the case, preventing more serious illness, and might lead to the identification of the source of lead, and either its removal or implementation of practices for its safe handling and use. Surveillance is also recognized as a mechanism for quick response. Although evidence from a surveillance program may not be considered definitive, it may identify an occupational hazard long before any other technique. Occasionally, surveillance can suggest an intervention even though the specific agent responsible for the illness has not yet been identified. For example, improved ventilation often remedies acute respiratory symptoms regardless of whether the irritant has been isolated or measured.

However, surveillance is rarely recognized as an important contributor to the process of policy development and evaluation. This paper will describe how epidemiological surveillance enhances disease prevention capabilities and supports policy development.

First, a few definitions need to be clarified. Screening represents a search to identify individuals with early, usually preclinical, disease. Based on the results of a screening test, individuals are sorted into groups, one of which requires some action or follow-up, and the other no further action. Screening may be conducted once, or it may be repeated in order to identify new cases. Nevertheless, the rationale for screening is to benefit the individual participant. Medical Monitoring also focuses on individuals, but includes a time component. Individuals identified for monitoring (either because of the presence of disease or known occupational exposure) are tested or examined periodically in order to detect changes (positive or negative) in one or more indicators of disease or health. Monitoring facilitates the medical management of individuals with occupational disease, and, because of the repeated measurements or tests over time, enhances the ability to detect relatively small changes in those without disease, even though the actual test results (based on a binary classification scheme, as in screening) would not be considered positive. Medical Surveillance focuses on individuals, generally includes a time dimension, but additionally incorporates an element of workplace hazard identification and potential intervention. Individuals are periodically examined for evidence of occupational (and sometimes other) disease, mainly for purposes of early identification and treatment. Among those with signs or symptoms, the occupational history may be scrutinized for clues relating to potential exposures or other risk factors. Through workplace environmental intervention, medical surveillance provides a basis for primary prevention of occupational illness. Epidemiological Surveillance resembles medical surveillance, but its focus is on groups of employees (determined on the basis of occupational risk factors), and other possible explanatory factors, or potential confounders, may be taken into account. It is very useful for primary prevention of disease and for policy support.

Collection, maintenance, analysis, and interpretation of epidemiological surveillance data, without other measures, do nothing to prevent occupational disease and injury. Some mechanism for translating results obtained from surveillance into appropriate interventions and beneficial policy must be available and functional. In an industrial setting, this mechanism must include the resources, administrative support, and authority to recommend, implement, and evaluate these interventions and policy decisions. Four stages of a systematic and objective assessment of surveillance data are: (1) Assess validity and precision of data used for surveillance purposes. Bad data will lead to lost ability to detect occupational hazards as well as possibly spurious results. (2) Determine the potential for bias, or systematic error in the data stemming from low participation or from the methods of data collection. (3) If data are of reasonable quality, analyze by comparing disease and health indicators among groups with different levels of exposure or other risk factors. Determine role of potential confounders. (4) Verify results by cross-checking with other data or results, repeating the assessment in other similar settings (another plant, a different time period), recommending additional investigations such as industrial hygiene measures, or suggesting a more definitive epidemiological study.

An epidemiological surveillance system is useful after an intervention has been implemented or a policy change made to improve occupational health, in terms of evaluation. If an implemented intervention is effective, disease rates or other indicators should change accordingly.

Four examples of medical or epidemiological surveillance in the United States chemical industry are presented. Although not a representative or comprehensive sample, they collectively illustrate several approaches, philosophies, and stages of development.

- **The Chlorine Industry**: Approximately eight companies in the United States are considered major producers of chlorine gas. Although several of these companies are phasing out one of the two most common processes for producing chlorine (using "mercury cells"), hundreds of employees continue to be potentially exposed to substantial quantities of inorganic mercury vapor. For these workers, a medical surveillance program has been recommended by the Chlorine Institute, the chlorine manufacturers' and users' trade association. As outlined by the Chlorine Institute, the surveillance program is intended to monitor employees for undue exposure to mercury, evaluate worker and industrial hygiene practices, and assist in the medical management of overexposed workers. Data routinely collected include results from preplacement and periodic physical examinations, as well as monthly or bimonthly urinalyses. Urine results may be corrected for volume (dilution or concentration due to variable hydration), using specific gravity or creatinine.

Historically and today, this surveillance system has had various prevention and policy implications. For example, urinary mercury results, combined with clinical examinations, were used to derive exposure limits that were thought to prevent symptoms in workers. The policy that resulted, still in effect today, requires: urinalysis if 8-hour exposure exceeds 50 $\mu g/m^3$, review of worker hygiene if total mercury exceeds 200 µg/l on two monthly tests, removal from the job if total mercury exceeds 300 µg/l, and return to work when total mercury is below 200 µg/l.

Although most experts, including those representing the Chlorine Institute, agree that these levels are inadequate to protect employees from subclinical levels of kidney damage, the data collected are being used to help determine a new standard. (The American Conference of Governmental Industrial Hygienists, the group responsible for recommending standards, has proposed a urinary mercury limit of 35 µg/g creatinine.)

Occidental Chemical Company: This company has developed and implemented a medical surveillance program, now available to all employees bi-annually (and annually to some employees, because of exposure histories and age). Currently, the surveillance program conducts tests for hearing loss, high blood pressure, and reduced lung function. In addition, an occupational history, demographic characteristics, and a medical history are obtained. All data are subject to strict quality control, and are automatically recorded on computer disks. The main objective of the present system is to identify hearing loss and decline in lung function as early as possible. For individuals identified by this system, another objective is to assess their work environments and check the availability and use of protective equipment. At this stage of surveillance development, however, disease and injury prevention is mainly limited to secondary prevention, and policy decisions are limited to the management of individuals.

Now that the medical surveillance program is in place and has operated smoothly for a year and a half, work has started on developing an epidemiological surveillance system that will use pulmonary function data and demographic data, and eventually incorporate portions of the industrial hygiene system. The earliest version of this system will evaluate changes in lung function by exposure categories, controlling for important predictors of lung function, including smoking history, gender, height, and weight, in order to identify possible occupational respiratory hazards. The potential for the earliest workplace intervention is greatly enhanced by expanding the medical system to an epidemiological system, whose data for policy formulation are likely to be more valid and useful. Compared to establishment of the medical system, enhancement is inexpensive, despite the valuable information to be gained.

Monsanto Company: Monsanto has conducted medical and hazard (industrial hygiene) surveillance for decades, and for over 10 years the medical surveillance system has been automated. Annual or biennial clinical examinations of employees have generated over 1,000,000 records, including data on lung function, blood chemistry, urinalyses, and physical status. All data collection instruments are standardized, and essentially have not changed since the computerized system began. Computerized files that contain standardized demographic, occupational history, and exposure data are also available. This surveillance system has been used mainly for medical surveillance of individuals—not epidemiologically to search for potential health hazards in the workplace. Monsanto plans to develop active epidemiological surveillance capabilities within the next several years.

Although the primary prevention role of the current system is limited, the policy implications are interesting, reflecting a somewhat different philosophy. The data are not routinely evaluated as they would be in a surveillance system, but they have provided the basis for a number of epidemiological studies. In essence, the collected data are available as needed to address emerging or important research questions. For example, when the United States Occupational Safety and Health Administration (OSHA) required industry to conduct medical surveillance of workers exposed to benzene, Monsanto initiated a study that utilized data on benzene exposure and on hematologic measures routinely obtained in the medical surveillance program. The two main research questions were: (1) Do groups exposed to benzene differ from other plant employees with respect to hematologic parameters? and (2) Is there a dose-response relationship? The study found no differences by exposure group, but documented important differences related to age, gender, race, and smoking. This study, based on epidemiological analysis of surveillance data, provided information potentially useful in formulating policy related to the use of hematologic measures. It also underscored the importance of considering potential confounders in epidemiological surveillance.

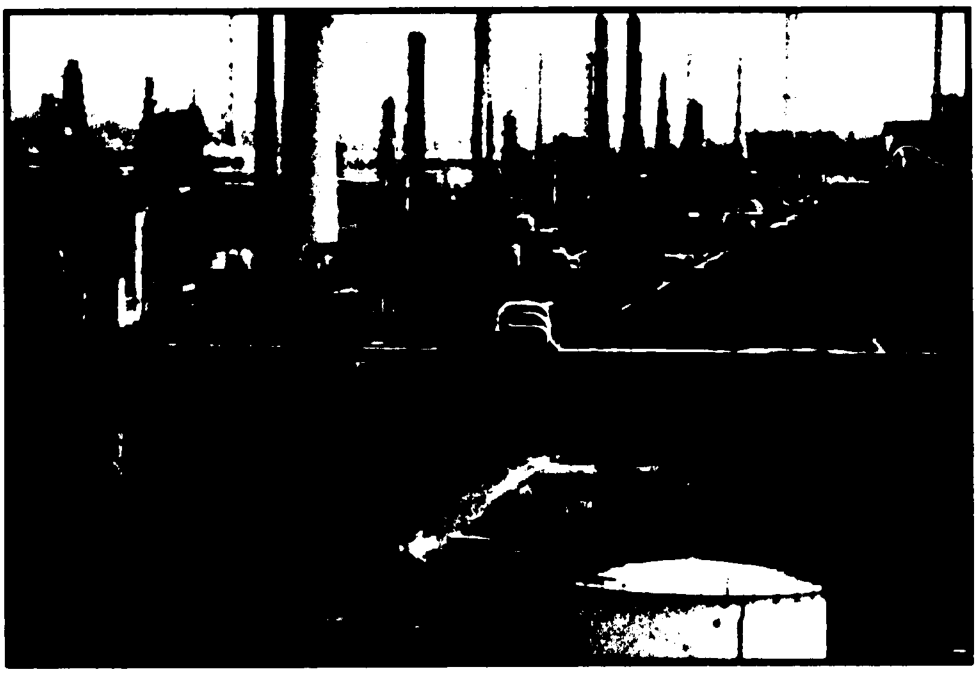
E.I. du Pont de Nemours Company: Of the four examples provided, the occupational surveillance system at Du Pont most resembles epidemiological surveillance. This system, which focuses on all-cause mortality and cancer endpoints, can be used to actively identify areas with apparent excesses of specific cancer or mortality. Excesses are typically discovered by comparing the observed number of events with an expected number (SMR analysis), based on the general population living near the plants or based on the overall Du Pont population. These excesses may be examined by gender, age, year, and occupational categories based on potential exposure or production type.

Because this system has been in place for several years, and the procedures for data acquisition, organization, and analysis have been standardized, Du Pont is now interested in evaluating the validity and utility of new, or previously unused, sources of data. Most notable of these sources of potentially useful data is the medical claims database, which accumulates approximately 2,000,000 claims per year for employees and their dependents. The medical claims data will be assessed and merged with the existing epidemiological surveillance system, not only to detect occupational diseases and patterns, but also to provide information on medical costs by chemical products used or made, geographic region, and other issues. It is expected that these results will provide some objective bases for examining health care and insurance costs. If epidemiology programs can use existing surveillance databases to target interventions to reduce company health care costs, these departments may receive greater management and financial support for more active disease prevention and health promotion activities. This is especially important when there is a weak economy, as corporate epidemiology programs seem particularly vulnerable to budget reduction.

Conclusion: If appropriately designed, an epidemiological surveillance system can provide a scientific basis for making policy decisions potentially benefitting employee health, as well as evaluating these decisions. Unlike a traditional medical surveillance approach, epidemiological surveillance can identify high-risk groups in order to better focus intervention. Because of the group-level analysis, the role of other explanatory factors (potential confounders) may be taken into consideration when rates (risks) are compared, increasing the validity of the results. Therefore, epidemiological surveillance results may be most efficient and effective as a strategy for disease prevention and policy formation. Relatively modest additional effort and resources are needed beyond existing informational and medical surveillance systems to create or enhance their epidemiological surveillance capability. Those contemplating developing occupational surveillance should consider the epidemiological approach.

REFERENCE

1. Collins, J.J. et al. 1991. A Study of the Hematologic Effects of Chronic Low-Level Exposure to Benzene. Journal of Occupational Medicine 33:619-626.



Oil refinery at Plock.

THE SILESIAN ENVIRONMENTAL HEALTH MONITORING PROGRAM: A TOOL TO SUPPORT POLICY AND ACTION

Jerzy A. Sokal
Institute of Occupational Medicine in the Mining and Metallurgical Industry
Silesian Environmental Health Monitoring Programme
Sosnowiec, Poland

Even a very rough examination of the air pollution distribution in Europe can easily identify the large, densely populated area in southern Poland, northwestern Czechoslovakia, and southeastern Germany that has high levels of air pollution. The Upper Silesia region of Poland can be considered a great ecological disaster. Existing and future data on this region can contribute substantially to our knowledge on the impact of environmental pollution on human health.

Upper Silesia is a historical and geographical name of a region in southern Poland, belonging to the administrative province of Katowice. Its central part includes only urban areas. For technical and statistical reasons, I will primarily consider data on the administrative province of Katowice in my presentation.

The area of this province is 6,650 km^2 (2.1 percent of the area of Poland). Its population was approximately 4 million in 1988, and population density was 600 persons per km^2. Almost 88 percent of its population is urban.

It is the most industrialized area of Poland. About 98 percent of coal (150 million tons per year) is mined here, and all of the lead and zinc production in Poland is here. About 53 percent of steel, 35 percent of coke, and 29 percent of energy production (all by coal combustion) is in the province of Katowice. In 1985, industry emitted 454,000 tons of dust (25 percent of national emissions) and 1.5 million tons of gases (31 percent of national emissions), including 750,000 tons of sulfur dioxide (64 percent of national emissions). Industry produced, in 1986, 92 million tons of wastes, over half of the total waste disposal in the country.

The health status of the population in the province of Katowice is significantly worse than in the rest of Poland and in Warsaw. Life expectancy and cause of death data are shown in Table 1 and Figure 1. Infant mortality data are presented in Figure 2.

The critical question is whether, and to what extent, the health status of the Katowice population is affected by air pollution, and more generally by environmental pollution. The public is convinced that the degraded environment is the main cause of ill health and also that health statistics underestimate risk.

TABLE 1: LIFE EXPECTANCY			
		Katowice	Poland
1963-65	Men	67.4	67.5
	Women	73.7	72.9
1981-85	Men	65.8	66.9
	Women	73.8	75.1

Figure 1: Standardized Mortality Ratios, by Cause
Warsaw and Katowice

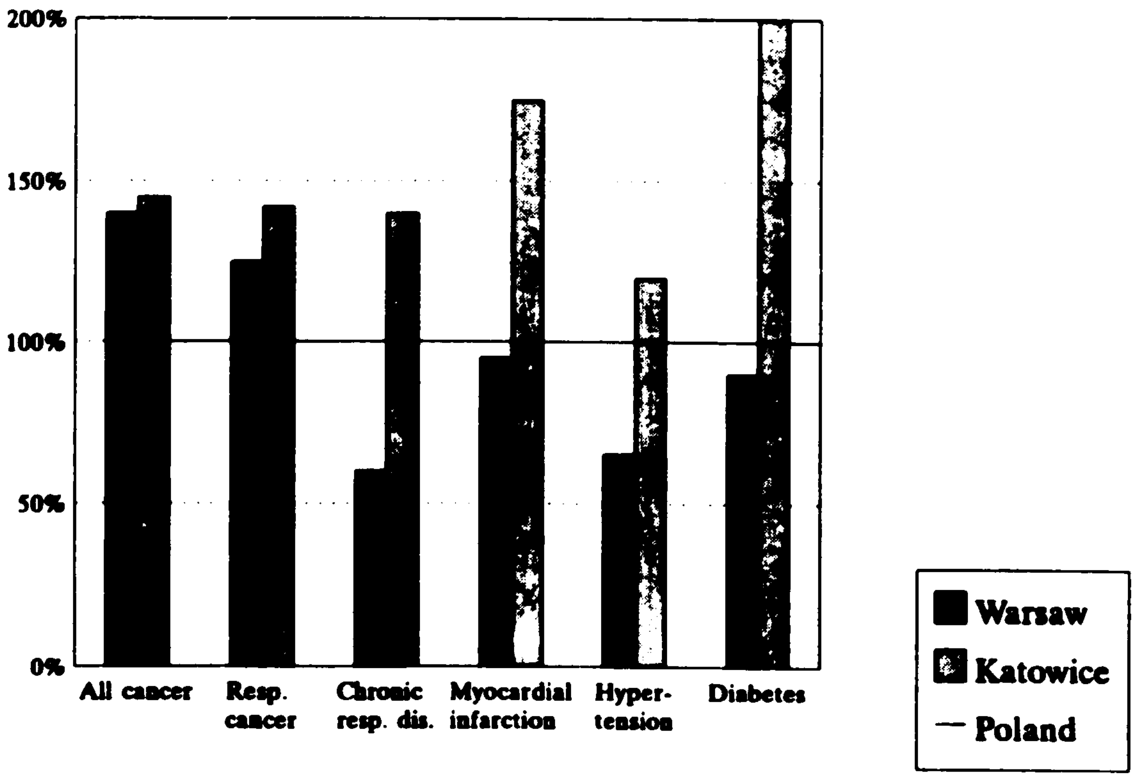
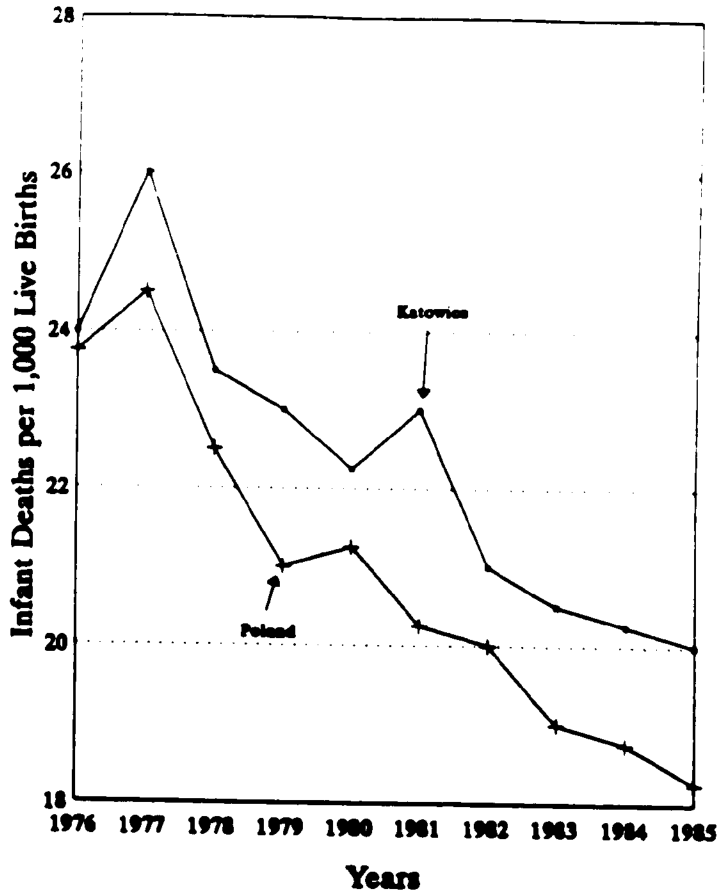


Figure 2: Infant Mortality, Katowice and Poland as a Whole
by Years -- 1976-1985

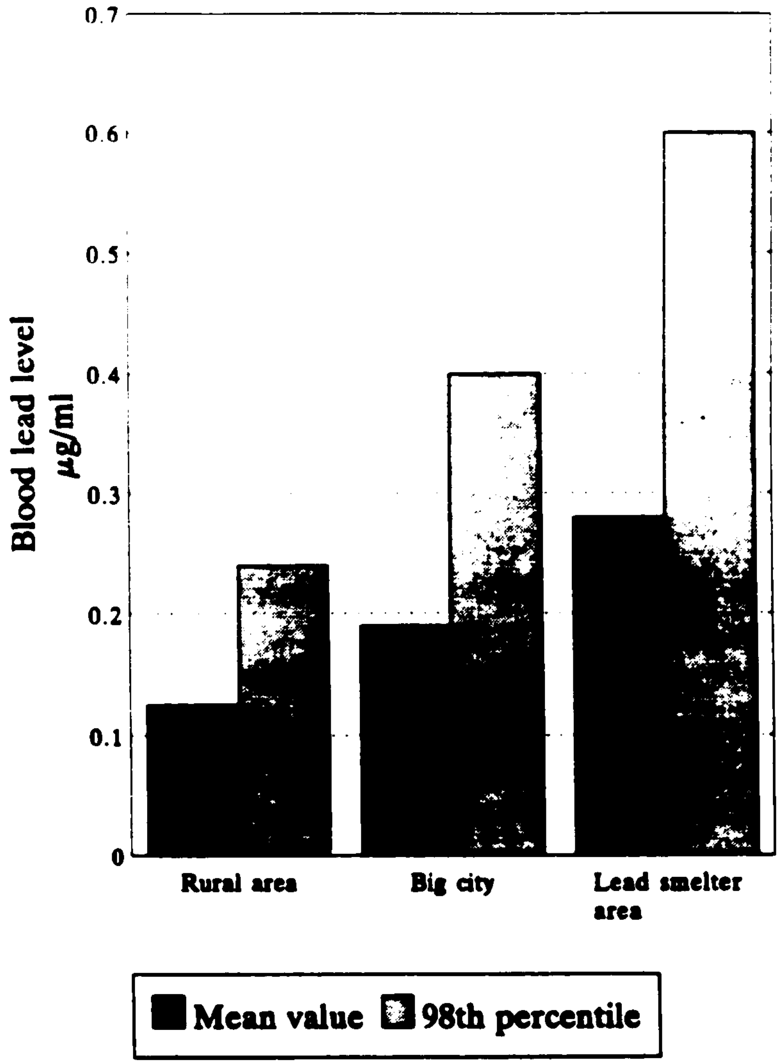


Although many data exist on environmental quality and possible environment-related health effects in the province of Katowice, comprehensive, quantitative, health risk assessment has not yet been performed. Problems are still open for critical evaluation of existing pertinent data, most of which have not been published. New research needs to be done, preferably with international cooperation.

Several observations strongly suggest a causal association between the health status of the population and the quality of air in particular and environment in general.

Many studies have correlated mortality rates with air pollution, either expressed as a total pollution load or as the concentrations of specific pollutants. For example, the mortality rate from myocardial infarction (heart attack) correlates well with carbon monoxide concentrations ($r=0.78$). A weaker, but still statistically significant, correlation was found between infant mortality and the annual average concentrations of sulfur dioxide ($r=0.444$) and total suspended particulates ($r=0.522$). No correlation was found between infant mortality and concentration of nitrogen oxides. Any individual correlation may not sufficiently prove a causal relationship, but the total body of correlation evidence is rather convincing.

Figure 3: Blood Lead in Children in Katowice Province



Excess cancer mortality in Katowice province is in reasonable agreement with the excess predicted from exposure to environmental carcinogens (polycyclic aromatic hydrocarbons, chromium, nickel, cadmium, and arsenic). More supporting evidence comes from morbidity observations, showing increased occurrence of certain health effects with exposure to air pollutants: sickness absence among pregnant women, sickness absence from peripheral nervous system diseases, respiratory diseases in children and adults, circulatory system diseases, and kidney disfunction.

A rather comprehensive survey of blood lead has been performed during the last 10 to 15 years by the Katowice Sanitary-Epidemiologic Station. About 12,000 children and about 5,000 adults (mostly mothers of these children) were examined. The results are alarming (Figure 3), and this situation has not improved for the past 10 to 15 years. In some children living near lead smelters, encephalopathic signs and symptoms were identified in the 1980s.

The Polish government, being acutely aware of the alarming level of natural environmental pollution in our country, has made a decision to take some immediate steps to reduce pollution-induced adverse health effects. The remedial actions are to be focused, first of all, on the regions of the highest pollution and of the greatest population density in the southern part of Poland. Particular attention is to be paid to Upper Silesia, which undoubtedly is the most hazardous area due to concentration there of the mining and metallurgical industries and a high degree of urbanization.

The most effective use of national and international financial resources for this purpose is quick identification of the main health hazards, finding relationships between adverse health effects and pollutant sources, and developing appropriate preventive and remedial strategies.

Radical improvement may be expected only as a result of restructuring of industry, and solving the problems of heating- and traffic-induced pollution. However, some immediate actions limiting the adverse health effects due to environmental pollution should be taken without any delay.

Effective use of resources allocated for prevention and control of pollution relies on data from reliable studies, accompanied by continuous control of environmental health hazards. The Ministry of Health and Social Welfare has entrusted coordination of these studies to the Institute of Occupational Medicine in the Mining and Metallurgical Industry and to me, as its director.

The Institute, which is located in Sosnowiec, has been involved for over 40 years in studies of the relationship between health and the work environment in the numerous industrial plants in Upper Silesia. The Institute is now extending its scope of activities to environmental health problems. Near the Institute there are other scientific centers and laboratories that deal with environmental pollution and its impact on health. These include the Silesian Medical Academy, the Regional Sanitary-Epidemiologic Station, the Institute of Oncology, the Institute for Environmental Protection, and others. The activities of the centers and institutions related to environmental health are being coordinated and integrated by the Scientific Coordinating Committee of the project "Monitoring the Environmental Health Hazards in the Katowice Region" that is chaired by me. The Committee has developed a draft program for monitoring environmental health hazards (Tables 2 and 3) and has planned activities aimed at limiting the pollution-induced adverse health effects. Immediate remedial actions include environmental health education and promotion, prevention of lead poisoning in children (CDC system), and an alert system for smog episodes. The Polish government will allocate some funds for the implementation of this program, but, due to the difficult economic situation of our country, these funds will not be sufficient. We expect that additional funds can be obtained within the framework of international collaboration. Experience gained from this program could be extended to cover other regions of Poland where significant environmental health hazards also occur.

TABLE 2: CHEMICALS SELECTED FOR MONITORING
SO_2, SPM, NO_2, O_3
Lead, Cadmium
Asbestos, arsenic, benzene, chromium, nickel, PAHs

TABLE 3: MAIN LINES OF THE MONITORING PROGRAM
Health status based on general indicators
Population exposure to carcinogens, cancer mortality and cancer incidence
Prevalence of allergic diseases and blood immunoglobulin level
Lead exposure and related health effects
Cadmium exposure and related health effects
Smog episodes and related health effects

Dr. Jerzy Sokal and other symposium participants are interviewed by broadcast journalists.

MONITORING ENVIRONMENTAL POLLUTION AND HEALTH OF THE POPULATION IN POLAND: FROM WORLD BANK PROJECT TO NATIONAL PROGRAM*

presented by
Pawel Gorynski
National Institute of Hygiene
Warsaw, Poland

The often unsatisfactory quality of data on environmental contamination and the inadequate assessment of human health problems are important drawbacks in evaluating and understanding environmental health problems in Poland. World Bank experts in 1990 stimulated the establishment of the Environmental Management Project—a group of small, but significant, environmental health activities. Its aims are: (a) improving the quality of data on environmental pollution collected through the network of sanitary-epidemiologic ("san-epi") stations; (b) determining where the most hazardous areas in Poland are, based on health data and data on ambient air and water quality; and (c) training epidemiologists to deal with the major health problems arising from exposure to environmental contamination.

The existing systems of data quality that control for food contaminants and occupational exposure have three components: implementation of unified analytical methods, training of analytical staff in sanitary epidemiologic stations, and inter-laboratory testing. These activities have been organized by the National Institute of Hygiene (NIH) and the Nofer Institute of Occupational Medicine (IOM). Inter-laboratory tests for food are conducted approximately every 2 years. This system is insufficient for quality control of data, especially since "san-epi" stations have different equipment.

The first objective of the project is improvement of analytical reliability of results from environmental and biological monitoring. To fulfill this objective, the NIH has selected approximately 12 regional "san-epi" stations that already are adequately equipped to provide data on contaminants in the environment. Special consideration is given to standardization of equipment in these stations. For food analysis, the analytical staff of these stations have been trained at the NIH, and inter-laboratory tests are performed twice a year. This system has been implemented for pesticides and heavy metals in food. All field "san-epi" stations conduct quality assurance for water from waterworks and public wells. The IOM implemented in 1986 a program of analytical quality control for occupational exposure monitoring. Inter-laboratory tests are conducted twice a year. The program concerns occupational health divisions of all 49 district "san-epi" stations and about 20 major territorial stations. This activity has proved to be very promising: over several years, the number of laboratories tested that fail to meet the quality requirements has been reduced from almost 50 percent to about 25 percent.

* Authors of this paper are Paweł Gorynski and Bogdan Wojtyniak.

At present, progress in subprojects is as follows:

Monitoring of the heavy metals: The Department of Food Research of the NIH organized inter-laboratory testing. Food samples containing metal ions typical for mineralized food samples ("artificial ash") were distributed and analyzed. No systematic errors were reported and measurement precision was good. A two-day training course on determination of lead, cadmium, mercury, zinc, and copper in food products, using the atomic absorption spectroscopy (AAS) method, was organized for 38 "san-epi" station employees.

Biological monitoring of persistent organochlorine compounds in food and in material of human origin: The NIH joined international analytical quality control exercises organized by the Swedish National Food Administration. Results of this trial were considered acceptable. This examination was followed by a inter-laboratory trial of persistent organochlorine detection in food and in material of human origin in eight "san-epi" station laboratories.

Monitoring of aromatic hydrocarbons and other parameters of drinking water and atmosphere: During the first stage of work, the NIH has developed analytical procedures for the following contaminants: chlorobenzene, chlorophenols, 1,1-dichloroethane, heptachlor and its epoxide, formaldehyde, hexachlorobenzene, pentachlorophenol, carbon tetrachloride, tetrachloroethane, and trichloroethane. All procedures were based on chromatography methods. The developed methods, after preliminary implementation in laboratories of "san-epi" stations, will be subjected to the inter-laboratory trials organized by the NIH.

Monitoring of toxic substances in workplaces: A quality control trial undertaken by the Nofer IOM in 1991 consisted of 10 samples tested for ammonia and iron at five different concentrations. In the last two control rounds, the percentage of nonproficient laboratories was 22 percent and 20 percent. It has been suggested that the number of industrial hygiene laboratories in Poland should be reduced, enabling concentration of skilled staff members and high quality equipment.

Monitoring of the heavy metals in biological materials (biological monitoring): The analytical method has been developed for the determination in fat and milk of DDT and its metabolites (DDD and DDE); alpha-, beta-, and gamma-HCH hexachlorobenzene (HCB); and polychlorinated biphenyls (PCBs). The method, simple and cost-effective, is used for routine analysis. These criteria are of great importance for expansion of biological monitoring through the network of "san-epi" stations. This project also aims to modify collection, analysis, and reporting of information on health status and its relation to environment contamination.

Improving the existing system of health data collection, analysis, and reporting: Projects being performed by the NIH are designed to (a) modify cause-specific analysis and presentation of mortality and morbidity to demonstrate the magnitude of environmentally related diseases; (b) identify regions with health problems possibly related to environmental contamination; and (c) improve capabilities of presentation and dissemination of data on health effects related to environmental factors. The information that is now available has several limitations, the most serious of which is differing forms of aggregation and tabulation of data by different institutions. To overcome this problem, raw data on health and environment will be gathered by two centers working in close collaboration. Computer hardware is now being installed in the NIH, and data collected in the hospital morbidity study have been modified.

Quantitative evaluation of 27 areas of ecological hazards with special emphasis on health aspects: Based on routinely collected data and quantitative indices, an aggregate index of environmental hazards in specific areas was calculated by the IOM. As compared with the rest of Poland, areas with ecological hazards have a higher index of hazard.

Introduction of total exposure assessment (TEA) methodology: This project creates institutional conditions for TEA studies at the NIH. It will enable theoretical and practical training in methods of air pollution exposure assessment and evaluation of its respiratory effects.

Training on environmental epidemiology methods: The NIH helped organize a workshop to familiarize researchers with methods of environmental epidemiology. Thirty-five Polish epidemiologists from major institutes and academic centers and two from the Hungarian NIH participated. Seminars given by specialists from the United States, Israel, and Great Britain will be published by WHO's European Center for Environment and Health in the Netherlands.

Determining guidelines for the preparation of the Register of Chemical Substances in Poland: Out of numerous registers of chemical substances worldwide, the United States register meets Polish requirements best. Guidelines for preparation of the Polish register were based on those of the United States. The World Bank project will be completed in 1993. In each area of activity, it will enable participating institutions and scientists to have an opportunity to: (a) improve quality of the data collected in existing or developed systems; (b) develop or implement in Poland new analytical and environmental epidemiology methods; (c) upgrade technical equipment in laboratories; and (d) strengthen and expand knowledge through study tours abroad. The project will help develop modern monitoring of health effects due to environmental pollution.

The environmental monitoring system has separate subsystems, such as air monitoring, surface water monitoring, groundwater monitoring, and food monitoring. In addition to the system at the national level, some regional systems will be created in the most hazardous areas in the country, such as Upper Silesia. Monitoring of the health effects of environmental pollution will be conducted by the Ministry of Health. The IOM and the NIH are responsible for the program and implementation through the "san-epi" stations. The four main areas are: (a) assessment of human health status based on routinely collected data; (b) assessment of ambient air pollution and water contamination, based on data from "san-epi" stations throughout the country; (c) biological monitoring of heavy metals in blood; and (d) special epidemiological studies in areas selected on the basis of results from routinely collected data on health and the environment. (Food monitoring may become a part of this monitoring system or a subsystem of monitoring crops that is operated by the Ministry of Agriculture.) Monitoring of health effects due to environmental factors will enable evaluation of the third strategic target of the Polish National Health Program: "Decrease of diseases related to the harmful living and working place environment."

WORLD BANK PROJECTS IN POLAND: REMARKS ON ACCEPTANCE OF HONORARY MEMBERSHIP IN THE POLISH SOCIETY OF HYGIENE

Janusz Bajsarowicz
United States Committee On Poland's Environment
Berkeley, California, USA

I will describe four programs that the World Bank is implementing in Poland. This is the first time that the World Bank has given a loan directly to an environmental center, in this case, to the Ministry of Environmental Protection in Poland—for $18 million.

The first program is a management program that provides training for environmental managers in the Ministry.

The second program is providing training for environmental auditors in Poland in a joint effort between the Ministry of Industry and the Ministry of Environmental Protection. The program consists of sending a group of Western and Polish specialists to enterprises, which were selected by the Minister of Industry in order to determine industrial environmental energy efficiency of each enterprise—that is, to perform an environmental compliance audit, something that never occurred before in Central and Eastern Europe or the former Soviet Union. The Polish specialists are trained by performing these audits with the guidance of Western specialists. These audits address complex problems that include questions of protecting the environment while maintaining employment and developing the economy.

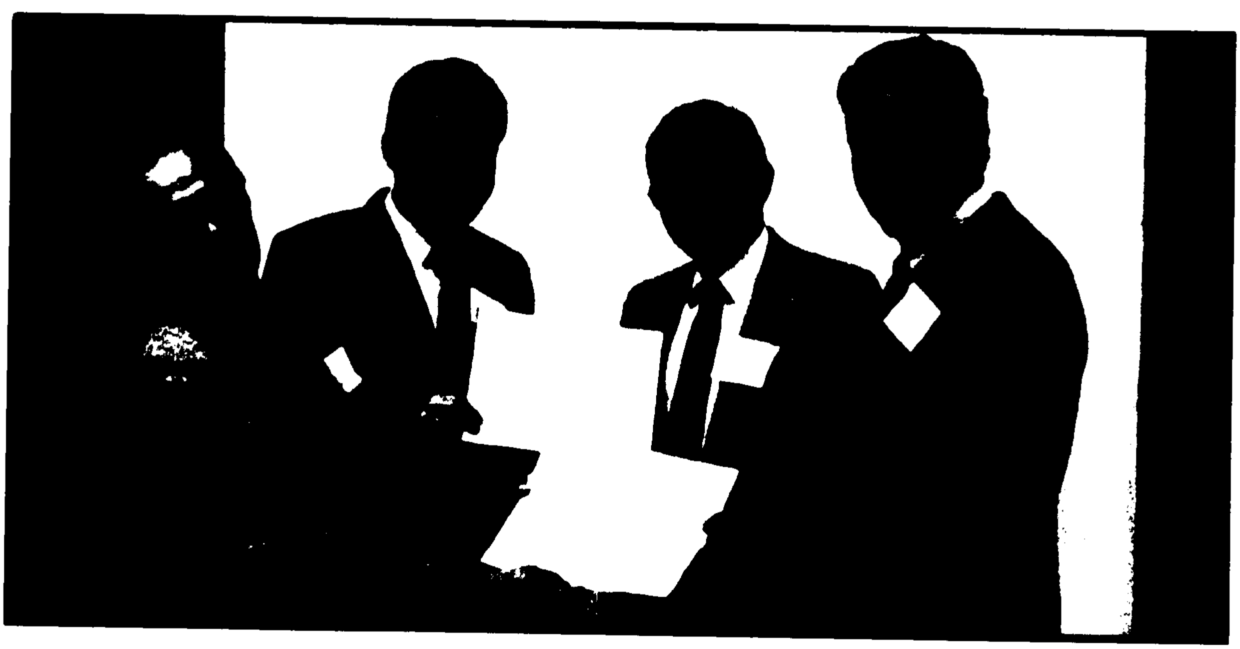
The third program pertains to air quality monitoring and air quality management, a program that is just now starting up. It helps to establish monitoring stations, mainly in southwestern Poland where the biggest air pollution problems in the country exist. It also provides training on how to operate these stations, how to obtain and analyze data, how to interpret data in terms of international standards, and how to integrate data so that other people can use the data.

The fourth program focuses on pollution of surface and ground water. In this program, money is being provided for establishing two permanent laboratories, fully equipped, with the most modern equipment available, plus two or three model laboratories that will enable the inspectorate portion of the Ministry to test samples taken on site at specific locations or specific enterprises to determine the type and concentration of contaminants present.

I am a consultant to the World Bank and the Ministry of Environmental Protection, Natural Resources and Forestry concerning these programs. I participated in discussions on which projects to support first: installing scrubbers in power plants, or building more sewage treatment or industrial-waste treatment plants, or training, or monitoring. Our conclusion was that it would be more productive in the long run to spend initial funding for training programs. We have to keep in mind the sustainable development concept that states that we must think about providing economic means for the present generation and always keep in mind the future.

Common sense tells us that we should not do things that will destroy the environment for future generations. Unfortunately, common sense did not exist here for many years. I disagree with some of the speakers at this symposium who said there was no environmental policy in Poland. Yes, there was a policy: the absence of policy was a policy! There was a conscious effort to put economic and military development in front of any other considerations. Therefore, the task to change this policy has to start with changing the mentality of the people. Let me present a specific example. There is a steel mill near Krakow, where the workers are being exposed to many dangerous compounds. The working conditions are appalling. The plant has a negative impact on the environment. The plant has no apparent benefit to the national economy. And yet, workers say, "We don't want to close down. We don't want to be unemployed." So, what do you do in a situation like this? The first thing is educate the workers. You must make an effort to educate people to enable them to begin thinking differently.

Unemployment is preferable to occupational and environmental exposure to extremely dangerous conditions that may result in serious health effects. Unemployment may not be the best choice, but it is probably a better choice in some situations. Unemployment may provide time to retrain workers. These are the kinds of issues and questions that the World Bank and some of the bilateral aid agencies from Western Europe, the United States, and Japan are facing. Do we just provide money for construction, or changes in equipment, or for training people and trying to change their attitudes?



Dr. Cezary Korczak and Dr. Jan Sobotka present certificates for honorary membership in the Polish Society of Hygiene to Dr. Janusz Bajsarowicz and Dr. Jerome Wesolowski.

THE ROLE OF RISK ASSESSMENT IN ENVIRONMENTAL POLICY

Jerome J. Wesolowski
California Department of Health Services,
University of California, Berkeley, and
United States Committee on Poland's Environment
Berkeley, California, USA

A focus of this symposium is on the relation between science and the environmental decision-making process used to protect the health and welfare of the citizens of Central and Eastern European countries. This paper will discuss the role of one important scientific discipline in the decision-making process: risk assessment.

Figure 1 shows the relations among research, risk assessment, and risk management. The research provides the basic information needed to assess risks, and risk assessment is used to make risk management decisions. The risk assessment process is usually divided into four steps: hazard identification, understanding dose-response, exposure assessment, and risk characterization. Risk characterization, as we shall see, requires input of both risk assessors and managers. However, it is still considered one of the risk assessment steps. I will not present details on how one obtains the information for these steps. Rather, some real world examples will be given which demonstrate the kinds of uncertainties involved in some of these steps, and how a lack of understanding of these uncertainties can lead to wrong risk management decisions. The paper will end with recommendations on how to minimize these difficulties.

DOSE-RESPONSE ASSESSMENT

First, let us deal with the uncertainties with the dose-response information base. Often, animal data must be used to obtain dose-response information. However, there are uncertainties in using models to extrapolate from high doses used in animal experiments to the low doses expected in the general population.

An example of the large uncertainties that result when using different assumptions, particularly different models, concerns dioxin. Figure 2, developed by the United States Environmental Protection Agency (EPA), shows the allowable daily dose guidelines chosen by various agencies as a *safe* dose (1). They cover a range of about three orders of magnitude. These uncertainties are not just of academic interest. One of the main reasons it is almost impossible to obtain a permit to build a hazardous waste incinerator in the United States is due to the assumption that dioxin, often a by-product of the incineration process, is one of the most potent human carcinogens known. Recent scientific evidence has caused EPA to reconsider the potency of dioxin. Should it be demonstrated that dioxin is not nearly as potent a carcinogen as it was believed to be, then the original risk estimates have led to inappropriate and costly policy decisions.

Figure 1: National Academy of Sciences/National Research Council
Risk Assessment/Management Paradigm
(Source: Popp, 1991)

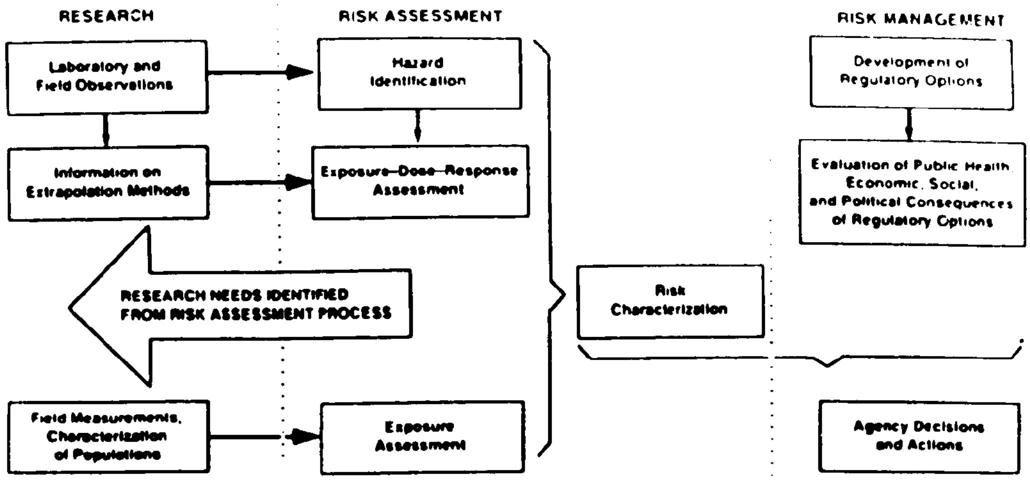


Figure 2: Allowable Daily Dose Guidelines of Various Agencies
(Source: Paustenbach, et al., 1990)

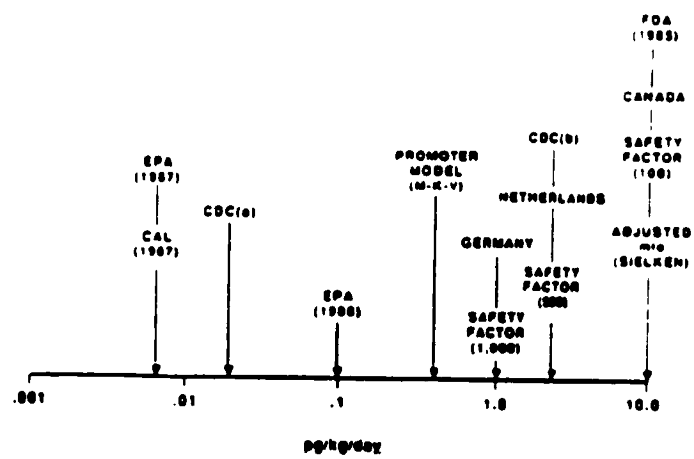
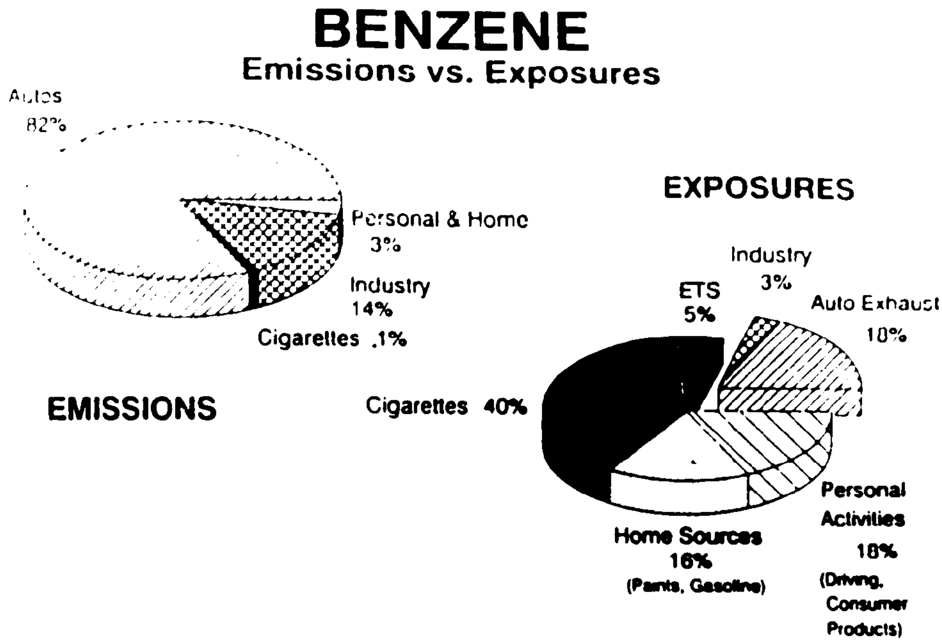


Figure 2. Recently, the U.S. EPA evaluated all the various national and international health guidelines for dioxin in an effort to select the most appropriate one. As shown here, equally credible scientific bodies can occasionally have very different views about what constitutes a safe level of human exposure to a chemical. This plot presents the doses considered virtually safe or those that may pose a theoretical cancer risk of 1 in 1,000,000.

Figure 3: The importance of exposure when estimating the impact on public health



EXPOSURE ASSESSMENT

Before discussing exposure assessment, let us recall the difference between concentration and exposure. *Concentration* is the amount of a given contaminant in a given medium per unit volume of that medium at some specific time (such as µg/m^3 of lead in air). Human *exposure*, on the other hand, is the contact at one or more boundary layers between the human and the environment with a contaminant at a specific concentration for a specified period of time. The contact can be with the surface of the respiratory tract (usually taken to mean at the mouth or nose), the gastrointestinal tract, or the skin. Thus, the units are concentration multiplied by time (such as µg/m^3 • hours). From the point of view of health effects, exposure, not concentration, is the critical parameter.

Time does not permit a discussion of the various methods that are used to measure a person's or a population's exposure. A good overview is given in a recent United States National Academy of Sciences report (2). Although there is much room for error and uncertainty in the exposure assessment process, I believe exposure assessments, if carried out properly and with adequate quality control, often will yield the most reliable information of the four steps of the risk assessment process.

We will emphasize exposure assessment's critical role in environmental decision-making. This will be done by examples. The first example relates to control decisions concerning the important pollutant benzene. One of the pie charts in Figure 3 shows that the greatest contributions of benzene emissions in the United States come from automobiles and industry. The other pie chart shows estimates of actual human exposures. The automobile contribution to *exposures* is only 18

TABLE 1: COMPARISON OF PARTICULATE EMISSIONS AND EXPOSURES FROM COAL-FIRED POWER PLANTS AND ENVIRONMENTAL TOBACCO SMOKE IN THE UNITED STATES

Factor	Unit	Coal In Power Plants	Environmental Tobacco Smoke (Cigarettes)
Total amount burned in 1985	Million tons	630	0.81
Emission factor[a]	g/kg	0.8	24
Total particulate emissions	Thousand tons	500	19
Exposure factor[b]	EU/ton	100	170,000[c]
Total population exposure	Million EU	50	3,200

[a] Grams of particulates released into the air per kilogram of fuel burned. The figure for coal power plants indicates the amount released using control systems currently in place.

[b] The number of exposure units (EU) created per ton of particulate emissions. One EU is equivalent to 1 person inhaling 1 microgram of pollutant per cubic meter of air for 1 year.

[c] In households

Note: Although only a 4 percent reduction in coal power plant *emissions* (20,000 tons) would counterbalance all the ETS particulates, less than a 2 percent reduction in ETS *exposures* would be equivalent to elimination of all exposures from coal power plants. For details of these calculations, see J.A. Roumasset and K.R. Smith, "Exposure Trading: An Approach to More Efficient Air Pollution Control," WP no. 7 (Honolulu: East-West Environment and Policy Institute, 1988).

Source: Smith, 1988

percent compared to the 82 percent of its contribution to *emissions*; similarly, industry's contribution to exposures has dropped to 3 percent. On the other hand, the contribution of active cigarette smoking is the largest contributor (40 percent) to a populations *exposure*, and environmental tobacco smoke contributes 5 percent. The emission pie chart would lead to the conclusion that the major controls to be considered are for automobiles and industry, but the exposure chart demonstrates that a different mix of controls may be appropriate.

Another striking example that demonstrates the importance of using exposure in the decision-making process is a comparison of possible United States control strategies for particulates based on either emissions or exposures (3). Table 1 shows that the total amount of coal burned is much more than cigarette tobacco burned. However, cigarettes have an emission factor about 25 times greater than that of coal. Multiplying these factors yields total yearly particulate emissions from coal of 500 tons, but only 19 tons for cigarettes. Thus, reducing power plant emissions by only 4 percent is equivalent to eliminating all environmental tobacco smoke (ETS) emissions. However, from a public health perspective, it is the population's exposure that is most relevant. It has been calculated that the ETS exposure factor is 170,000 EU units per ton compared to only 100 for power plants. (An EU unit is equivalent to 1 person inhaling 1 microgram of pollutant per cubic meter of air for 1 year.) This is not surprising, since power plant emissions are released from tall stacks located relatively far from people compared to ETS emissions. Thus, the population *exposure* from ETS is far greater than that from coal (of course, exposure of smokers to mainstream smoke is even much greater). In fact, a 2 percent reduction in ETS exposure is equivalent to eliminating particulate exposure from all United States power plants. It would be interesting to carry out such a calculation for Central and Eastern European countries, where coal is in such high use, and with far fewer controls, but where there is a much higher percentage of smokers than in the United States. This discussion does not imply that Central and Eastern European countries should not put emission controls on their power plants, but only that when trying to protect the public from particulate pollution other control strategies should also be considered.

These examples should demonstrate the importance of exposure assessment in the decision-making process. Of course, reducing emissions also reduces exposure, but the choice of which emissions reductions to focus on should be based on the expected relative exposure reduction to the population. Most control legislation is designed around reducing emissions, not exposure. Thus, expensive control strategies are sometimes implemented that do little to reduce population exposure. But this does not have to be the case. An example of legislation based on exposure will now be discussed.

In California, citizens have a mechanism to place proposed legislation on election ballots. In 1986, California voters passed Proposition 65, called the Safe Drinking Water and Toxic Enforcement Act of 1986. It required the Governor to develop a list of chemicals known to cause cancer or reproductive toxic effects. It is a complex law. Only one aspect, namely that dealing with warnings, will be discussed. This aspect simply says that 12 months after the listing of a chemical, people may not knowingly be exposed to significant amounts of that chemical without first receiving a warning. These exposures include occupational exposures, air exposures, water exposures, and exposures from consumer products. The language of the law was imprecise, particularly with respect to the various definitions and terms used. For example, what is meant by "significant amount"? The Governor charged the California Health and Welfare Agency, with implementing the law in a manner that was based on a ***scientifically sound foundation*** (4).

The "no significant cancer risk" level was then defined by the Health and Welfare Agency, after input from scientists, other agencies, industry, environmental groups, and the public, as one resulting in 1 excess cancer case per 100,000 people exposed for a lifetime. One of the most unique features of the measure is that it departs drastically from the traditional environmental regulatory process by allowing for private citizen enforcement. This feature works in the following way. Any individual or group may inform the appropriate public authorities, such as the Attorney General, of an intention to sue a business that they believe is violating a provision of the measure. The authorities have 60 days to begin prosecuting the purported violation. If they do not, the citizen or group is allowed to proceed with the suit and, if successful, will retain a portion of the penalties imposed by the law. This is commonly called the "bounty hunter's provision."

A recent consumer product case illustrates how the process works. It involved a product many clerical workers and graphic artists use regularly, namely typing correction fluids. The case was initiated by an environmental group, which claimed various manufacturers were in violation of the adequate warning provision of Proposition 65 because their products allegedly contained amounts of trichloroethylene (TCE) sufficient to cause significant cancer risk to consumers using the product in a reasonable way. Randomly selected samples were purchased from retailers and brought to my laboratory for analysis. The chemists determined that many of the products did contain TCE in amounts of about 30 to 50 percent by weight.

Of course, the question is not what is in the bottle but what is the consumer's exposure. Proposition 65 simply refers to the "level in question." The California Health and Welfare Agency has interpreted this to mean that exposure which is the result of the *reasonably* anticipated use at an *average* rate of consumption by the *typical* consumer. Although it can be argued that this is still somewhat vague, it does make it clear that exposure estimates are not to be based on the worst possible scenario.

The exposure was calculated using a mass balance model and the calculations were compared to actual exposure measurements. Reasonable assumptions were made for input to the mass balance model. For example, it was assumed that a typical use of the product might involve correcting 10 standard type characters. The weight of the correction fluid needed to white out 10 standard type characters was determined by weighing the bottle of correction fluid before and after such a use. A use frequency of one application every 2 hours during the workday by a typical office worker was assumed, working in an office with a volume of 40 m^3 and an air change rate of 0.5 ach. The exposure model calculation indicated a typical office worker would receive an exposure more than 100 times higher than that which would pose no significant risk under Proposition 65 guidelines. These calculations were verified by simulating the use of these products by a researcher in an exposure chamber.

The Attorney General decided that this was sufficiently high to proceed with the case. Many of the correction fluid manufacturers decided to reformulate their products rather than face lengthy litigation.

These examples demonstrate the importance of exposure assessment in the decision-making process. Central and Eastern European countries will likely want to develop and maintain a competent scientific exposure assessment capability.

RISK CHARACTERIZATION

Risk characterization does not require new information, but, rather, uses the information obtained in the first three steps, aggregating it to estimate incidence for specific population groups. However, risk characterization is not straightforward because it requires that judgments be made regarding such issues as which dose-response and exposure assessments to use, what the statistical and biological uncertainties in the health effects measured are, and which population groups should be the primary targets for protection.

Risk characterization is a joint responsibility of manager and scientist. However, the fact that scientists make some of these choices (for example, which extrapolation model to use) does not make the choices devoid of policy implications. For example, in deciding between a threshold or a no-threshold model, a scientist will be using facts, personal experience (often called intuition), and personal values. The scientist may say that the choice was made on informed scientific judgment. However, to others, the choice may appear to be a public health value decision on how conservative a regulatory policy should be. These types of judgments are referred to as *risk assessment policy.*

Agencies in many governments have determined that it would be wise to have written guidelines for making these choices. These are referred to as *inference guidelines*. Typically, inference guidelines have at least four sections: hazard identification, dose-response, exposure assessment, and risk characterization. Each section contains details on how to go about carrying out that step of the assessment. For example, the guidelines may recommend the use of a linear no-threshold model in the dose-response section.

Clearly, the risk assessor must interact with the risk manager in this area of risk assessment policy. A real world example can be used to demonstrate the importance of this interaction. Let us suppose a risk manager is concerned about indoor air quality policy, and particularly the carcinogen, radon. He or she could go to the risk assessor and ask the question, "How many people die each year in the United States from radon exposure, compared to other pollutants such as carbon monoxide, asbestos, and volatile organic compounds?" The risk assessor might estimate that 16,000 people die from radon, many more than from the other pollutants (5). Thus, from a public health perspective, the risk manager would conclude that radon reduction strategies should have a high priority. However, the risk assessor should have pointed out that from the point of view of making policy decisions, the question was biased since it did not include the possibility of synergism with smoking nor did it include deaths from an important and ubiquitous pollutant, environmental tobacco smoke (ETS). If that had been asked, the resulting relative risk assessment would have looked much different. ***Due to the large synergistic effect between radon and smoking, only 1,500 cases of the 16,000 predicted would occur if the present United States population consisted entirely of lifelong nonsmokers***. Put simply, a successful program to stop smoking would eliminate over 90 percent of the radon-associated lung cancer risk. Further, the number of non-smokers who die each year from ETS would be about 50,000 (5). As this example illustrates, it is important to take into account all significant sources of pollutants, as well as synergisms, when characterizing risk.

RECOMMENDATIONS

I conclude with the following recommendations:

1. *Risk Assessment should be an integral and important part of the environmental decision-making process.* Although that may seem like an obvious recommendation, this is not the case in many countries at the present time. In fact, even in the United States, the use of risk assessment in the environmental decision making process was formally established by EPA only in the last decade.

2. *Inference guidelines should be developed for use by all environmental and health agencies in a country to help standardize and expedite the risk assessment process.* However, to assure that such guidelines are acceptable and used, much attention should be given to the *process* by which they are developed. For example, the development should include input not only from agency scientists and managers, but also from industry and the public. When developing guidelines for Central and Eastern European countries, it would be wise to consider the guidelines already developed by various agencies in other countries. But it would not be wise simply to adopt these guidelines as they are, since guidelines contain not only scientific information, but also scientific policy judgments. These judgments, to some extent, are a reflection of the values of the particular society in which they are generated. Thus, citizens of one country might wish to be more conservative or liberal in these judgments than those of another country.

3. *Risk assessment values should not be reported unless the range of uncertainty is also given.* The risk managers who made decisions about incinerators would have profited greatly had they been aware of the orders of magnitude uncertainty in the risk predicted for dioxin.

4. *"Worst case scenario" risk assessment values should be used only for screening purposes.* An exposure scenario is the set of facts and assumptions about how a specific type of exposure takes place for a specific subset of the population. "Worst case" usually refers to the exposure that occurs when everything that can plausibly happen to maximize exposure happens. This requires the repeated use of conservative assumptions when estimating exposure. For example, a few years ago, a United States Government agency assessed the dioxin hazard posed by municipal waste incinerators by estimating the cancer risk for a child who lived within 0.8 km from a hypothetical incinerator. The analysis seemed reasonable until one looked at the repeated use of conservative assumptions (6). It was assumed that the child ate about a teaspoon of dirt each day, that his house was downwind of the incinerator, that he ate fish from a pond near the incinerator, his fish consumption was at the 95 percentile level, he drank contaminated water from the pond, he ate food grown primarily from the family garden, and he drank milk from a cow that grazed on forage near the incinerator. Of course, this is not be a typical scenario, yet the risk associated with this scenario was the one reported by the press. Perhaps the "worst-case scenario" should be labelled the "implausible worst-case" scenario, since although

the individual worst case exposure parameters are each plausible in themselves, it is implausible that they would all happen to the same individual. Thus it is recommended that "worst-case" scenarios not be used, except as screening tools (using "back-of-the-envelope" calculations) to determine if more refined and realistic risk assessments for reasonable scenarios are warranted.

5. *All significant sources of pollutants, as well as synergisms, should be taken into account when carrying out risk characterizations.* This will maximize the improvement of public health through intelligent and cost-effective environmental pollution reduction programs.

I trust that some of you, perhaps most, will agree with these recommendations. The difficult part will be to take action on them on a regular basis.

REFERENCES

1. Paustenbach, D.J., Jernigan, J.D., Finley, B.L., Ripple, S.R. and Keenan, R.E. 1990. Current Practice of Health Risk Assessment: Potential Impact on Standards for Toxic Air Contaminants. J. Air Waste Manage. Assoc. 40:1620-1630.

2. National Research Council (NRC). 1991. Human Exposure Assessment for Airborne Pollutants. Washington, DC: National Academy Press.

3. Smith, K.R. 1988. Air Pollution, Part I of II—Assessing Total Exposure in the United States. Environment 30:8.

4. Kizer, W., Warriner, Thomas E., and Book, S. A. 1988. Sound Science in the Implementation of Public Policy - A Case Report on California's Proposition 65. Journal of the American Medical Association 260:951-955.

5. Glantz, S.A. and Parmley, W.W. 1991. Passive Smoking and Heart Disease—Epidemiology, Physiology, and Biochemistry. Circulation 83:1-12.

6. Nazaroff, W.W. and Teichman, K. 1990. Indoor Radon: Exploring United States Federal Policy of Controlling Human Exposures. Environmental Science and Technology 24:774-782.

7. Popp, A. 1991. Risk Assessment Practices in the Federal Government. Chemical Industry Institute of Toxicology.11:1-2.

8. Wallace, L.A. 1990. Private Communication.

ENVIRONMENTAL RISK ASSESSMENT: ONE PHYSICIAN'S PERSPECTIVE

Joe LaDou
University of California at San Francisco
School of Medicine
San Francisco, California, USA

The National Research Council of the United States National Academy of Sciences concluded from a recent study that toxicologists have fairly complete information on health hazards for only 10 percent of pesticides and only 18 percent of drugs in use today. Moreover, at least one-third of pesticides and drugs have never been tested for toxicity. The problem with common commercial chemicals is even more serious, since nearly 80 percent of them have never been tested, and little is known about many that have been studied.

Many occupational health and safety professionals assume that industry exposure standards are determined on the basis of health effects. Quite to the contrary, virtually all exposure standards are the result of no more science than an awareness of recognition or irritation levels. In fact, United States exposure standards are legislated and enforced without health effects studies, as demonstrated by Material Safety Data Sheets. For virtually all of the 80,000 chemicals commonly used in United States industry, there is no information available on the chronic health effects anticipated from workplace or environmental exposure.

In California, for example, the Government regulates the airborne levels (maximum permissible airborne concentrations are termed Permissible Exposure Levels, or PELs) of 400 chemicals. But it does so after determining permissible levels through a largely political process, heavily influenced by what is achievable by industry. Sixty-seven of the regulated chemicals are carcinogens. Here again, the chemicals are not regulated on the cancer endpoint, but rather on what is commonly referred to as "technology-based," rather than "health-based," standards.

The explanation for this absurd situation is only partly that of industry control of the political process. There is a serious problem with the science of standard-setting that is not being addressed with sufficient intent by most governments around the world. Basic toxicology is cumbersome and expensive, and the translation of animal research into human health outcomes is inexact at best. In addition, the contribution of epidemiology to the science of occupational and environmental medicine has been more confusing than beneficial over the past four decades.

Epidemiological studies are generally inadequate for detecting relative risks for a particular cancer below about 1.5—that is, a 50 percent increase in risk. Since the background lifetime risk of developing lung cancer, for example, is approximately 1 in 25, an exposure resulting in a lifetime increase in lung cancer rates of 50 percent would lead to an increased lifetime risk of developing lung cancer equal to 1 in 50, or 20,000 per million. Yet decisions about permissible population exposures by governmental agencies may involve cancer risks as low as 1 in a million. Thus, cancer risks that are considered acceptable, at least in the United States, are very much lower than ones that can be detected by epidemiological methods.

To complicate matters, most epidemiological research is conducted by inexperienced researchers who find little difficulty publishing even the most flawed studies. Scientific journal editors are, for the most part, scientists not trained to fully appreciate the broad opportunities for misinterpretation of epidemiological studies. This has given rise to a scientific literature that is bursting with unreliable and conflicting studies on virtually all industrial chemicals and environmental pollutants.

The United States is the largest per capita producer of hazardous waste in the world today. Each citizen produces about two tons of hazardous waste per year. There are about one million abandoned hazardous waste sites and contaminated pits, ponds, and lagoons in the United States. There is no technology available to remediate this enormous problem, and if there were, there is no public or governmental resolve willing to spend the large sums of money that remediation would entail.

The U.S. Environmental Protection Agency invests about 1 percent of its annual budget in basic toxicology research. It invests less than 0.1 percent in international activities. This neglect of research in favor of attention to politically expedient activities is not unusual for environmental agencies in other countries as well.

The sensitivity of epidemiological studies for determining health effects of exposure to hazardous waste sites is much too limited to be of use. There have been repeated conflicting studies in the U.S. on this topic. What is required is a major commitment to basic research in toxicology, a function of the Government that is almost universally ignored or disregarded.

THE ACCURACY AND SOCIAL BENEFITS OF EXPEDITED RISK ASSESSMENTS

Carl F. Cranor
Department of Philosophy
University of California
Riverside, California, USA

The present regulation of carcinogens is quite slow; hundreds of substances that have tested positive for carcinogenicity in animal bioassays have not been addressed by the United States regulatory system. This carries with it unappreciated social, economic, and public health costs. However, there are readily available expedited approximation procedures for assessing the potency of carcinogens that could be adopted instead. This paper addresses the social costs of time-consuming, labor-intensive, carcinogen potency assessments; shows the benefits of expedited procedures; and recommends expedited procedures for carcinogen or toxic substance risk assessment.

Background: In 1987, the United States Congress' Office of Technology Assessment Report, *Identifying and Regulating Carcinogens*, found that federal regulatory agencies had addressed fewer than one-third of the identified carcinogens under each of their statutory mandates (1). More seriously, only 15 percent of 144 carcinogens testing positive in one or more animal bioassays by the National Toxicology Program, and only 15 percent of 62 substances for which there was even better evidence of carcinogenicity, had been assessed by the Carcinogen Assessment Group (CAG) of the Environmental Protection Agency (EPA) by 1987.

Currently, about 369 substances have been identified as carcinogens under California's voter-passed initiative Proposition 65, the Safe Drinking Water Act of 1986. Of these, only 21 percent have received conventional potency evaluations to date. According to evidence presented at the Proposition 65 Science Advisory Panel, it takes an agency such as the California Environmental Protection Agency from 0.5 to 5.0 person-years per potency assessment using conventional risk assessment procedures. Thus, these are costly in terms of time, human resources, and money.

Although the slow rate of potency assessments is only part of the problem of regulatory delay, potency assessments have not kept pace with the production of animal bioassays, which are quite slow (taking from 5 to 10 years per assay) and can easily be accelerated. There are techniques available for expediting carcinogen potency assessments that are (a) scientifically sound, (b) in better accord with environmental health statutes, (c) much lower in social costs, (d) more health protective, and (e) capable of providing a more consistent regulatory environment for affected industries.

Analysis: Federal and state agencies, such as the United States EPA and the California EPA, use standard default assumptions to estimate cancer risks. While the calculation of cancer potency estimates based on standard procedures is relatively straightforward, the production of conventional risk assessments can take up to 5 person-years. Some resources are spent on activities essential to the conventional analysis—tracking down the pertinent literature, identifying the appropriate data sets for analysis, weeding out poor data, and determining whether or not the ancillary data on pharmacokinetics and mechanism of carcinogenesis warrant abandoning generic risk assessment assumptions. However, substantial additional resources are spent on non-critical activities (e.g., detailed reviews of data that are inadequate and production of non-default estimates that are not used) in order to demonstrate that the assessor has given full consideration to all potentially relevant data.

There are, however, potency assessment procedures available for use with data available from animal bioassays which greatly expedite this process and which could effectively make the assessment of carcinogens nearly contemporaneous with the latest results from animal bioassays.

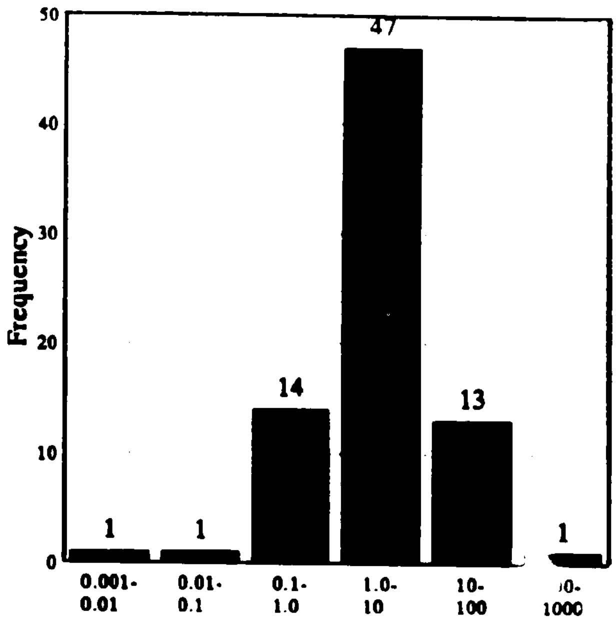
Two expedited approximation procedures described below make use of a carcinogenic potency database created by Gold and associates (2). Use of this database facilitates several tasks that take considerable time in conventional assessments: performing the literature search, exporting data from the analysis, identifying the most appropriate bioassay, and estimating the dose-response relationships. To estimate human cancer potency, potency values are derived from animal data, by means of the tumorigenic dose-rate 50 (TD_{50}) or the linearized multistage (LMS) default procedure. The LMS expedited procedure, adopted by the California EPA, differs from usual agency practice because it relies on cancer dose-response data evaluated and extracted from the original literature by Gold et al., thus eliminating the need for an extensive literature search, and under the expedited procedure, the choice of the multistage model is automatic and pharmacokinetic adjustments are not employed.

The default procedures rest on the following assumptions:

- The dose-response relationship for carcinogenic effects in the most sensitive species tested is representative of that in humans.
- Observed experimental results can be extrapolated across species by use of the interspecies factor based on "surface area scaling."
- The dose to the tissue giving rise to a tumor is assumed to be proportional to the administered dose.
- The multistage polynomial can be used to extrapolate potency outside the range of experimental observations to yield estimates of "low"-dose potency.
- Cancer hazard increases with the third power of age (3).

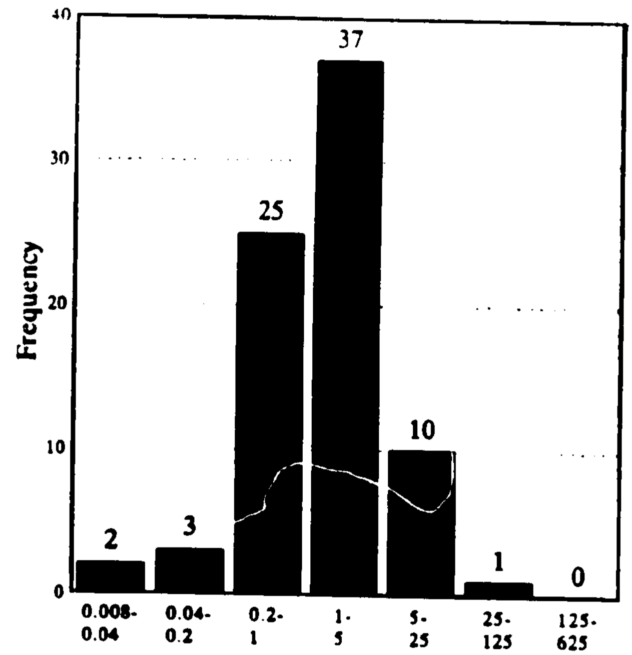
The State of California uses these five criteria to select the appropriate data set from the Carcinogenic Potency Database, to which several mathematical procedures are applied (4). The data selected are then used to calculate the low-dose cancer potency of the substance for animals

Figure 1: Relationship between TD_{50} Expedited Procedure Results (based on most sensitive target site species) with Results for the Same Substances Using Conventional Risk Assessment



Ratio of Potency Estimates
(Most Sensitve TD_{50}/Agency Q*)

Figure 2: Relationship between LMS Default (Expedited Potency) Procedure Results with Results for the Same Substances Using Conventional Risk Assessment

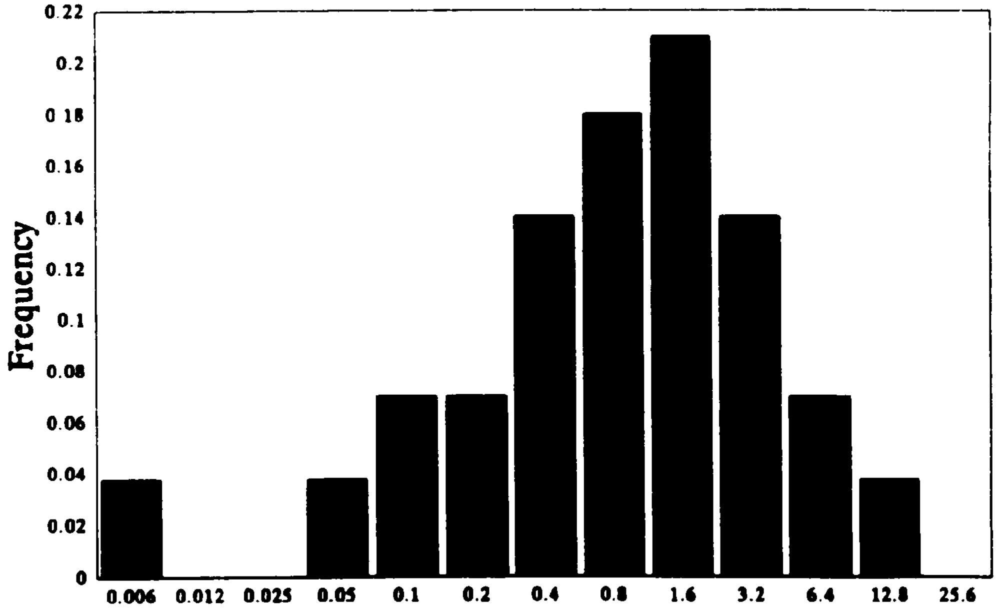


Ratio of Potency Estimate
(Expedited Potency/Conventional Potency)

and the results are then extrapolated to human beings. Both methods, which have been considered by the State of California, are extremely fast. The TD_{50} most sensitive experiment is the fastest since it requires only identification of the most sensitive target site and species from a database and a calculator for producing a potency number. The LMS procedure, using State of California-recommended database identification procedures and State-mandated default assumptions, is nearly as fast, but requires greater expertise in identifying the appropriate data set and an appropriate computer model. Both the TD_{50} and the LMS default method have been used by the California EPA to estimate carcinogen potency for 125 agents in 8 months in California, compared with 78 in the previous 5 years in California, and about 50 that have come out of the EPA carcinogen assessment group.

Figure 1 compares the correlation between the TD_{50} expedited procedure based on the most sensitive target site and species with results for the same substances using conventional risk assessment. Figure 2 compares the concordance between the LMS default and conventional procedures. The concordance between both the TD_{50} and the LMS procedures and conventional potency assessments is not significantly different from potency assessments on

Figure 3: Frequency Diagram of Differences between EPA and CDHS Potency Values



Potency Ratio: CDHS Potency/EPA Potency (logarithmic scale)

the same data performed by two different agencies, such as the United States EPA and the California EPA. For 48 substances evaluated by both the United States EPA and the California EPA using conventional methods, 12 percent differed by more than a factor of 10 and one by more than a factor of 25 (Figure 3). For 77 substances evaluated by the TD_{50} most sensitive site and species procedure and by conventional methods, about 21 percent of the TD_{50} potency values were off by a factor of 10 or more from conventionally derived potency numbers and 17 percent were off by a factor of 25 or more. For 78 substances evaluated by the LMS and conventional procedures by the California EPA, 10 percent of the LMS potency values were off by a factor of 10 or more, and 4 percent were off by a factor of 25 or more from conventionally derived potencies. Thus, the LMS and conventional procedures were as close in accuracy as two agencies using conventional science-intensive procedures to evaluate the same substances.

The case for using expedited procedures is made by a simulation or modelling argument to assess the social costs of using conventional risk assessment methods versus one of the two expedited procedures indicated above. This attempts to assess the best combination of rate and accuracy for potency assessments.

Risk assessments are at best rough guides for policy decisions because they are permeated with uncertainties. It is difficult to discover the " rue" risk for a carcinogen, for agencies may be off by an order of magnitude or more even when using the same data sets. Traditionally, agencies relying on quantitative risk assessments have been especially concerned about false positives and overregulation. Partly, cost has been a consideration: to avoid the loss of potential products or to avoid higher costs to industries, their shareholders, and the consumers of their products. Partly, scientists' evidentiary concerns have also played a role: to avoid adding unsubstantiated information to the base of scientific knowledge. However, agencies have also attempted in many cases to avoid underregulation for each substance by using potency assessment models that are not likely to underestimate the risks posed by a substance. However, there apparently has been less concern with avoiding health costs to the public resulting from identified, but unevaluated, carcinogens.

Conventional time-consuming procedures may have costs from unassessed substances. While expedited procedures may have costs from "inaccuracy." However, as indicated above, the expedited procedures produced results surprisingly close to more conventional time-consuming risk assessments for about 78 substances. Moreover, these procedures are scientifically sound, for one is derived from standard default assumptions (the TD_{50}), while the other is an instantiation of such defaults (the LMS default method). As is seen numerous times in the history of science and mathematics, approximations to expedite calculations or simplify the tasks are justified and appropriate. They appear quite appropriate here.

The discussion below compares accelerated potency assessments with conventional procedures for a universe of 369 substances listed as carcinogens under California's Proposition 65. This modelling, or simulation exercise, compares the total social costs of each procedure in order to evaluate the overall efficacy of risk assessment design. This simulation provides one way of getting at possible health costs associated with conventional assessments.

To account for the possibility of errors, the simulation model compares the costs of "mistakes" of expedited and conventional risk assessment procedures. The notion of a "mistake" is a technical term; it is not that assessors make calculation errors, or that they are careless. Instead, because of uncertainties, poor data, and poor understanding of mechanisms, risk assessors in performing any risk assessment may not discover the true risk (from a God's eye view) of a substance. Conventional risk assessments might result in mistakes by being slow and leaving identified carcinogens unassessed, as well as mistakes from uncertainties, poor data, and so on; expedited procedures might make mistakes by not assessing known carcinogens quite as intensively from a scientific point of view as on conventional procedures. In modelling social costs, values have been assigned for the cost of individual assessment mistakes for 369 substances evaluated by both procedures—regulatory false positives, regulatory false negatives, overregulation, and underregulation—and then aggregated or summed according to the kinds of mistakes the two different kinds of procedures might make.

Assume that out of 369 substances, 78 have been evaluated by conventional potency procedures to establish regulatory levels. This leaves 291 carcinogens (79 percent) that have not been evaluated and therefore should be considered regulatory false negatives—that is, while they are carcinogens, they are not treated as such by the regulatory system. All identified carcinogens are assumed to be human carcinogens in order to facilitate the initial comparison of risk assessment procedures.

For conventional risk assessment procedures, the model assumes that 94 percent of the substances that were assessed were assessed accurately, and that 6 percent of assessed substances are overregulated in a major way as a consequence of the health-conservative assumptions used by regulatory agencies in choosing potency models and in making data selections. For purposes of argument, the model incorporates the frequent assertion that these assumptions make it unlikely that quantitative risk assessments (QRAs) will result in the underregulation of specific compounds, although a case can be made that conventional procedures are not always conservative.

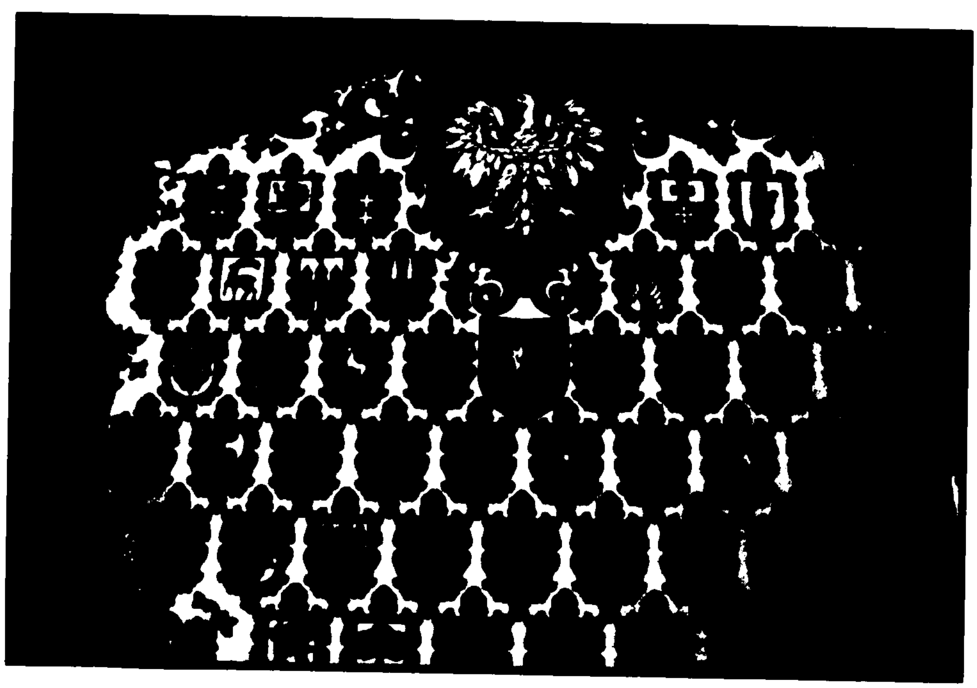
For expedited risk assessment procedures, the model assumes that all identified carcinogens (369) were evaluated for their potency, but that expedited potency estimates might depart somewhat further from the true risk (assuming that could be determined) than conventionally derived potency estimates. The TD_{50} and the LMS default procedure are both compared with California's science-intensive conventional risk assessments. "Accuracy rates" for the approximation methods are established by comparing them with the results of conventional assessments for 77 substances in the case of the TD_{50} procedure and for 78 substances in the case of the LMS default procedure. These are then extrapolated to the entire group of 369 substances. In order to compare the approximation procedures with a preassumed true risk, it is assumed that they result in 6 percent overregulation in addition to any divergences from conventional potency assessment.

Major overregulation or underregulation is assumed to occur when the potency value derived from the expedited procedure differs from the value obtained by conventional risk assessment by more than a factor of 25. Risk numbers that are off by a factor of 25 constitute a major divergence sufficient to result in different kinds of regulatory action. There typically is no bright line between the kinds of regulatory action until the differences between possible risk assessments is large; a factor of 25 is such a difference. For instance, the control strategies for a risk of 10^{-5} might be quite different from control strategies for a risk of $25x10^{-5}$. Moreover, since there legitimately can be a range of outcomes that are all reasonable from the same data, risk management considerations are likely to guide the regulatory strategy, unless the risk numbers differ too much. Finally, for the LMS default procedure, potency assessments that differ by a factor of 25 from conventional ones are more than two standard deviations from the mean according to data derived by the California Environmental Protection Agency.

Minor over- and underregulation is assumed to occur when the value derived from the expedited procedure departs from the value obtained by conventional risk assessment by more than a factor of 5 but less than a factor of 25. Any expedited potency value within a factor of 5 of conventionally derived potencies is assumed to be accurate, not a significant regulatory mistake.

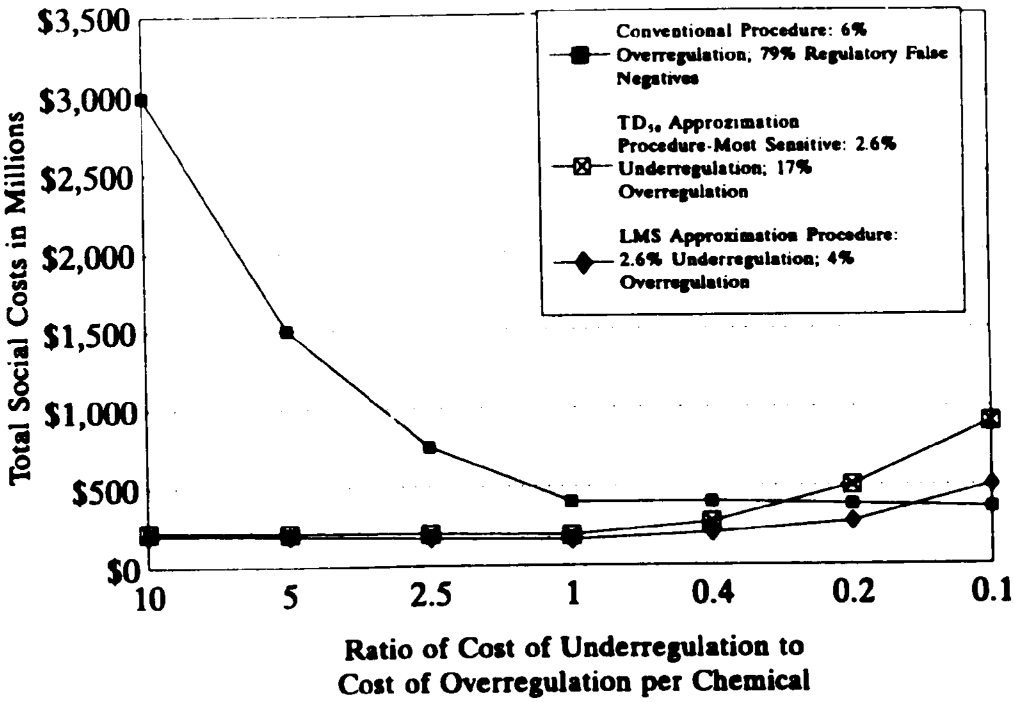
To complete the analysis, cost numbers were assigned for individual "mistakes" and then aggregated according to mistakes each procedure might make. Although individual cost estimates are debated, the model begins with a common assumption of many economists for theoretical or modelling purposes that regulatory false negatives on average across a wide range of substances cost $10 million (that is, not regulating a carcinogen imposes $10 million in health and other costs on society) and that regulatory false positives on average cost $1 million (that is, regulating a substance incorrectly as a carcinogen costs society $1 million in unnecessary compliance costs or foregone economic benefits). Such cost numbers are difficult to arrive at even for modelling purposes. On the one hand, there are substances that are carcinogens, but which pose no risk to human health because they are no longer in use or they are industrial intermediates in a closed manufacturing process with little or no human exposure. On the other hand, economists have found on the basis of labor market studies that the dollar value of an individual life lost varies from $1.8 million to $9.2 million, and the value of a life lost calculated on the basis of union wage studies varies from $3.2 million to $21 million. Depending upon the author, a best estimate from both kinds of studies is between $4 million and $8 million for a single life. However, these are estimated costs we are willing to pay to prevent the loss of one life, not the costs in terms of human life and health effects that one unregulated substance would cause. Moreover, while some carcinogens may pose no risk because there is no exposure, others, most notably asbestos, may cause death and disease for many. And, of course, some substances will be more valuable commercially than others and there will be some variance in the costs of overregulation and regulatory false-positives.

In order to avoid debates about appropriate cost ratios and to perform a kind of sensitivity analysis, in the analysis this 10:1 ratio was modified over a wide range (from 10:1 down to 1:10) to examine how the total costs associated with conventional and expedited procedures vary with assumptions about the relative health benefits and economic costs of regulation. The model incorporates the assumption that the cost of major overregulation is 90 percent of the cost of a



Coats of arms of various cities in Poland.

Figure 4: Comparison of Total Social Costs of Evaluating 369 Proposition-65 Carcinogens: Conventional Procedure versus Two Expedited Procedures

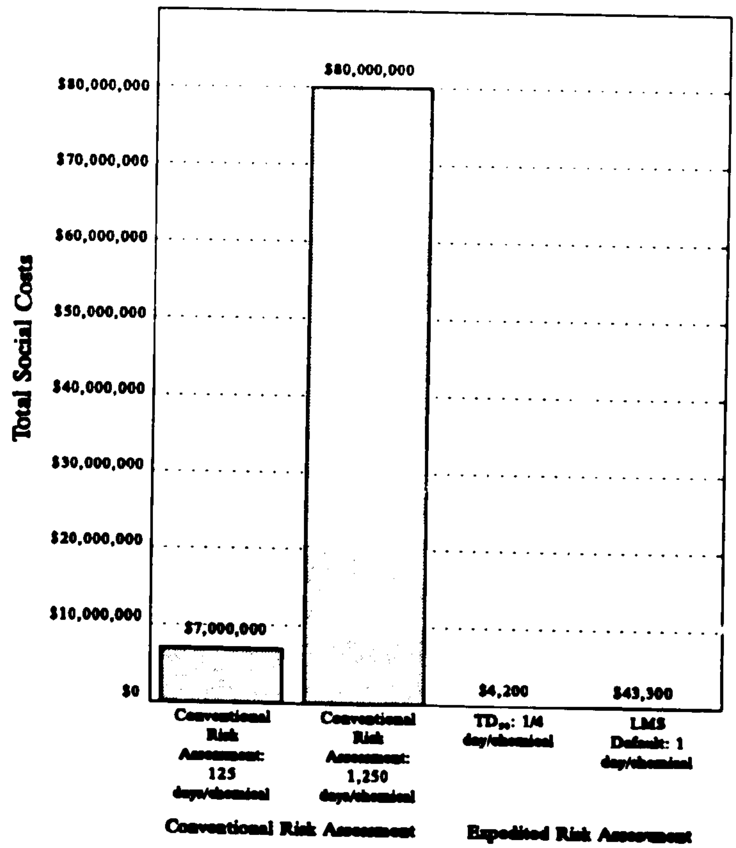


regulatory false positive and that the cost of major underregulation is 90 percent of the cost of a regulatory false negative. It also assumes that the cost of minor overregulation is 50 percent of the cost of major overregulation and that the costs of minor underregulation is 50 percent of the cost of major underregulation.

Figure 4 illustrates the simulation results for 369 substances, comparing conventional procedures with the two approximation methods discussed here. The total social costs of conventional risk assessment procedures are in general much greater than the costs of either expedited alternative. The cost advantage continues for both approximation alternatives until the individual costs of overregulation are assumed to be more than 250 percent of the individual costs of underregulation for either procedure. The cost advantage continues for the LMS approximation method until the costs of overregulation are more than 500 percent of the costs of underregulation. Moreover, even though the LMS approximation is substantially more "accurate" than the TD_{50} approximation, both are remarkably similar.

Commentators in the field appear to assume that the health costs of not regulating a carcinogen, on average, will be greater than the economic costs of incorrectly regulating a noncarcinogen. If this is true, it appears that approximation methods will always have a social cost advantage over conventional procedures for reasonable ratios of regulatory costs and benefits and reasonable error rates.

Figure 5: Total Social Costs for the California Environmental Protection Agency to Assess 200 Carcinogens by Conventional and Expedited Risk Assessment Procedures



This simulation provides strong economic and public health arguments for adopting expedited approximation risk assessment procedures. The costs assigned to underregulation and regulatory false negatives are an attempt symbolically and quantitatively to capture in an approximate way the public health costs of disease and premature death that might be caused by unregulated or underregulated carcinogens. Conventional methods appear to be very expensive when all social costs are taken into account. We appear to be paying a very high price for scientific caution and attempts at accuracy in risk assessment. The costs from slight or even substantial inaccuracies in expedited procedures are greatly outweighed by the gain in assessing a larger universe of substances.

In addition, if the costs of the evaluation or "testing" procedures were included as others have argued they should be, the advantage for expedited procedures would be even greater, because conventional assessments are expensive in terms of time, human resources, and money. Expedited evaluations are far less expensive (Figure 5). Thus, expedited procedures would have an advantage because they do not have the opportunity costs of conventional procedures (i.e., substances left unregulated) and the costs of the actual evaluation of each substance would be lower.

Moreover, the current presumption in agencies appears to be that science-intensive, case-by-case assessments are needed for every substance. However, the above results suggest to the contrary—that such assessments are necessary only if there is low human exposure and if the costs of regulating a substance are quite high compared to the risks to health. Regulatory procedures, thus, could be refined to make discriminations between substances, in order to utilize agency and social resources more efficiently and to better protect the public health.

For all the comparisons between conventional and expedited approximation procedures, the total social costs of expedited methods are always lower than conventional procedures across a wide range of values assigned for individual regulatory mistakes of underregulation and overregulation. In fact, up to the point at which the costs of individual overregulation is more than 250 percent of the individual costs of underregulation, the approximation procedures are always less expensive from a social point of view than conventional risk assessment procedures followed in current agency practices. Thus, it is better to evaluate a larger universe of known carcinogens somewhat less intensively for each substance than to evaluate a small proportion of that same universe very carefully and ignore the rest. A more science-intensive procedure appears justified only when there is low human exposure and the costs of regulation are high compared with the human health costs.

A generalization of this point is that careful, time-consuming scientific procedures can be costly in regulatory agencies, depending upon the circumstances. Where the public health is at stake, this suggests that agencies should seek more efficient approximation procedures both to identify and to evaluate carcinogens and other toxins so that we do not scrutinize substances with careful science while the public suffers. Efficiency is not ordinarily considered a virtue of scientific investigation, but in regulatory contexts it may be as important a consideration as accuracy in the assessment and identification of toxic substances.

REFERENCES

1. United States Congress, Office of Technology Assessment. 1987. Identifying and Regulating Carcinogens, Washington, DC: U.S. Government Printing Office.

2. Gold, L., Slone, T., Backman, G., et al. 1990. Third Chronological Supplement to the Carcinogenic Potency Database: Standardized Results of Animal Bioassays Published through December 1986 and by the National Toxicology Program through June 1987. Environmental Health Perspectives 84:215-285.

3. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment. April 1992. "Expedited Cancer Potency Values and Proposed Regulatory Levels for Certain Proposition 65 Carcinogens."

4. Cranor, C. 1993. Regulating Toxic Substances: A Philosophy of Science and the Law. Oxford: Oxford University Press.

RISK ASSESSMENT IN PRACTICE: THE CASE OF TETRACHLOROETHYLENE IN DRINKING WATER IN SLOVENIA

Davor Lovinicic
University Institute for Public Health and Social Welfare
Ljubljana, Slovenia

In Slovenia in the past decade, we have had some large and many small ecological problems, which have created much public awareness. The main product of the public awareness is the Green Party, which holds positions in Parliament trying to improve the environment and, on the local level, the highly-stressed syndrome "not in my back yard." A special problem showed up after the Chernobyl catastrophe: when changing the standards, we observed that people believed that nobody cares about them and that intentionally, because of economic benefits, they are being poisoned.

In situations with drinking water, it is very easy to deal with concentrations that greatly exceed the proposed limit standard. But what shall we do when the concentrations of pollutant are a little bit higher than standard? Shall we say, do not worry, it is all right, and let people think that we are poisoning them? Shall we close the supply, an action which costs much money that could be used for other purposes? At first look, whatever we do will not be accepted from the public, government, or my personal point of view.

In the case of drinking water, a quick approach to such problems can look like the following. In Slovenia we have Safe Drinking Water Quality Standards (SDWQS), which consist of 12 general parameters, standards for 50 pollutants and 106 pesticides, microbiological and radiological parameters, and standards for army poisons. Furthermore, we use WHO guidelines, European standards, EPA regulations, and any other available country standard. In our special case, tetrachloroethylene (TET) has a SDWQS of 10 µg/l. If the concentration of TET reaches about this level, it is a technical problem. But if it is above the SDWQS, then it becomes a political problem. Recently, we had to solve a problem for the Ministry of Health. The TET varied in concentration (shown below in µg/l):

	March 26, 1992	April 8, 1992
Well 1	11	11
Well 2	9	10
Well 3	10	15
Well 4	9	13
Well 5	3	12

It is obvious that the concentrations are not high enough to cause any problems. But we had to answer some questions: What to do? Should we close the wells? Should we drink this water? And if yes, for how long? The first step in this approach is: What is the chemical? TET is also known as perchloroethylene (PCE) and tetrachlorethene. It is mainly used as a dry cleaning agent, industrial degreaser, heat-transfer medium, in the manufacturing of fluorocarbons, and as an adjuvant in the foamed plastic industry. It is also generated in small quantities during water treatment process by chlorination. Chemically it is $Cl_2C=CCl_2$, which is very similar to the suspected carcinogen trichloroethylene (TRI), which in SDWQS is limited to 30 µg/l.

TET is a colorless liquid, with a molecular weight of 165.8, boiling point of 121 °C, melting point of -23.3°C, specific gravity of 1.625 at 20 °C, a vapor pressure of 19 mm Hg at 25 °C, and a vapor density of 1.12. It is practically insoluble in water (0.15 g/l at 25 °C), but it is soluble in ethanol, diethyl ether, chloroform, benzene, and oils. It is moderately toxic and a possible carcinogen. It is an experimental teratogen, it causes reproductive effects in experimental situations, data support its mutagenicity, and it is a severe irritant to the skin and eyes. At high exposures, it causes central nervous system depression and fatty infiltration of the liver and the kidney, with concomitant changes in serum enzyme activity levels indicative of tissue damage. TET is almost completely absorbed after ingestion or inhalation exposure. Most of the absorbed material is exhaled unchanged. Its half-life is between 34 and 72 hours. Small amounts (2-3 percent) of TET are metabolized to chlorinated metabolites as trichloroacetic acid, ethylene glycol, and oxalic acid.

According to WHO (1984), TET is widespread in the environment. Concentrations of TET found in drinking water have been: 35 µg/l in Germany; 21 µg/l in the USA; and 100 µg/l in Switzerland. There are not many data available on TET in food. Food levels in Great Britain have been shown to be: meat - 10 µg/kg, vegetables and fruit - 5 µg/kg, oils and fats - 7 µg/kg, dairy products - 3 µg/kg, and fresh bread - 1 µg/kg. In Switzerland and Germany, food intake is considered to be 100 µg/day. In Slovenia, we do not have any data on TET in food or daily intake of TET.

A look at different standards shows: Slovenia - 10 µg/l (1987), WHO - 10 µg/l (1984, 1990), US EPA - 5 µg/l -> 0 (1991), and European Community - 1 (for all chlorinated organic compounds)(1980). Sometimes, TET is considered a trihalomethane (THM) and is limited within THM limits. This is specially emphasized in the former Yugoslavia drinking water regulations, where THMs were limited with 30 µg/l and a special explanation of that parameter was written limiting TET to 10 µg/l. If we look from that angle we have: US (EPA) - 100 µg/l, Canada - 350 µg/l, and Yugoslavia - 30 µg/l.

The adjusted acceptable daily intake (AADI) is 85 µg/l. US EPA (1991) health advisories have been: 10 - kg child (one day - 2000 µg/l; ten day - 2000 µg/l; longer term - 1000 µg/l); 70-kg adult (longer term - 5000 µg/l); Reference Dose [an estimate of daily exposure to the human population that is likely to be without appreciable risk at lifetime] - 10 µg/kg/day; Drinking Water Equivalent Level [a lifetime exposure concentration protective of adverse, non-cancer health effects] - 500 µg/l; cancer risk µg/l at 10^{-4} - 70 µg/l).

Evaluating the risk assessment of a chemical in drinking water depends if the chemical is carcinogenic. As TET is potentially carcinogenic, we can use both of the approaches below:

First approach:

In the classical toxicological approach, a fundamental parameter used in the assessment of risk is the acceptable daily intake or ADI, or AADI if it is available. Using the most conservative approach that the highest concentration is everywhere in drinking water and that the average person drinks 2 liters of water per day, we compare it with AADI.

Maximum concentration	15 µg/l	or 30 µg/day/person
AADI	85 µg/l/day	

The maximum concentration in drinking water is 3 times smaller than the adjusted acceptable daily intake, which means that we can safely drink that water. Furthermore, we can calculate the No Observed Effect Level (NOEL) from the Maximum Acceptable Concentration as drinking water standard (MAC) and the Safety Factor (SF), and then calculate acceptable concentrations with different safety factors.

MAC = NOEL/SF

SF	MAC µg/l
100	10
50	20
25	40
20	50
15	66
10	100

Second approach:

Considering that TET is a carcinogen, we can use a linear-multistage model. If we consider that the linear-multistage model at low concentrations is: $R = q_1{}^* D$, and that we know water quality criteria at a risk of one in a million, we can calculate out $q_1{}^*$ and then for the different concentrations calculate risk. In this case, considering that the risk for 10 µg/l is one in a million we get:

10 µg/l	1 in million
20 µg/l	2 in million
40 µg/l	4 in million
50 µg/l	5 in million
66 µg/l	7 in million
100 µg/l	10 in million (or 1 in 100,000)

If we consider that a risk of one in a million is actually not a risk at all, one in 100,000 should be carefully considered before acceptance and one in 10,000 is not acceptable at all, then concentrations up to 66 µg/l would be acceptable.

Conclusion: A concentration of TET at 20 µg/l for 1 year would be acceptable. During that time, authorities must work on discovering the source of pollution and work on an alternative drinking water supply. Additionally, we are suggesting that authorities get stronger inspection control on all protected water areas with special emphasis on the chemicals. Next, they should ensure that there will be no additional potentially harmful activities for the water works system. A concentration of 20 μg/l is a compromise between calculated health acceptable values and reality. Toxicological data and knowledge of TET give us some confidence that this is still within an acceptable safety factor of 50. For higher concentrations, we do not have any human epidemiological data and we would have to monitor an exposed human population.

We are still emphasizing that for any chemical in drinking water that potentially is a carcinogen, there is not a safe dose or water quality criterion. The concentration of the chemical has to approach zero, and should not be introduced into the environment in the first place. The criterion is a product of society, which is forced because of pollution, need for drinking water, and financial and technical difficulties to accept compromise. The same is true in a given case. It is a compromise between the health effects of TET and poor sanitary conditions with no adequate water supply.

Personal protective equipment.

ENVIRONMENTAL HEALTH RISK ASSESSMENT, INCLUDING METHODS OF MEDICAL GEOGRAPHY*

presented by
Janusz Świątczak
Nofer Institute of Occupational Medicine
Łódź, Poland

Environmental health risk assessment is a very crucial element in the creation of ecological and health policy. The process of health risk assessment is, however, difficult and complicated and some say that it is a magic black box.

Numerous forms of the degradation of the environment, such as contamination with toxic substances of the air, water, and food, decreased soil fertility, and changed climate are reflected in disturbances in ecological conditions of the human population. As a result, pathological changes of various character and frequency could arise, both psychological and physical. Some people could develop adverse health effects, including reduced personal susceptibility and immunity.

The establishment of links between existing environmental hazards, human exposure, and health effects is not easy because genetic and lifestyle factors also operate.

In the process of health risk assessment, it is necessary to consider the entire sequence of events, starting with the sources of pollutants through their fate and transport in the environment, to human exposure, dose absorbed, and health effects.

The traditional method of health risk assessment is use of information from epidemiological investigations, which provides the percentage of the studied population showing the adverse health effects due to exposure to a specific chemical substance. Coexistence of multiple environmental factors often make the quantitative evaluation of cause-effect relationships very difficult.

In the case of environmental exposure that is relatively low and stretched out over time, search for health effects is difficult. Very often, environmental exposure is complex and no dominant factor or substance can be distinguished. In these cases, establishment of a cause-and-effect relationship by epidemiological studies is very difficult, especially if the health effects are non-specific.

Because of these reasons, application of epidemiological methods in health risk assessment has a limited chance of success. According to some authors, even high lifetime risks of 10^{-3} or 10^{-2}

* Authors of this paper are Tadeusz Dutkiewicz and Janusz Świątczak.

are hardly detectable by epidemiological methods. This is why for health risk assessment for low environmental exposures, methods based on relationships between the absorbed dose, health effects, and frequency of health effects in the population is increasing. The individual or population risk assessed most frequently is carcinogens for which the toxic action is well defined and stochastic—that is, the probability of its appearance depends on the overall exposure (total uptake in the defined period of exposure). For non-carcinogenic substances, the severity of effects depends usually on the level of the existing exposure. In this case, the effects can be observed only after the threshold level of exposure is exceeded. The relative possibility of adverse effects appearing in case of exposure to non-carcinogenic substances is based on comparison with the established reference dose, for the same period of exposure.

If the dose-response curve could be constructed, then prediction of expected response is possible. Reliability and validity of such calculations are usually loaded with an error when the level of exposure exceeds the reference dose value, because the response is not linear at higher levels of exposure and depends to a great extent on the features of the given chemical.

It is recommended that, under environmental conditions when combined exposure to toxic substances exists, synthetic measures of environmental contamination need to be elaborated. In a similar way, synthetic measures of a health status of the population can be constructed. It is hoped that such synthetic measures will better reflect the real environmental situation than indices of exposure to single toxins and indices of single health effects.

There exist also many attempts at the application of modern medical geography in health risk assessment related to environmental exposure to harmful factors.

The natural and socioeconomic factors are simultaneously taken into consideration. Modern medical geography combines the biological, medical, social, and economic phenomena into one territorial system.

To distinguish territorial systems, various research methods are applied which allow for elaboration of much basic information. Empirical and theoretical relationships are determined by the use of comparative geographical methods and by the use of cartographic, mathematic, or mathematic-cartographical modelling. Mathematical modelling is applied for the solution of such problems as identification and evaluation of adverse health effects of separate environmental factors and differentiation of territories into areas in which the relationships between man and environment are specific for the given region. Wide application becomes the mathematical model of information theory.

Most investigators who apply the method of information analysis concentrate on the space unit which is nosoarea. This is why all the conclusions from medico-geographical investigations have the space component. To disclose the unknown links of medico-biological phenomena with the environment, factorial analysis is applied which is very useful for differentiation of the investigated areas. Also, regression analysis has found wide application in the medical geography, especially when the form of the link between numerous accidental phenomena influencing human health in various ways is to be determined.

Multiple regression analysis is a good tool for medico-geographic evaluation of areas against the complex of factors influencing the life conditions and health of the population. By the use of this method, the influence of many factors on one phenomenon can be determined and simultaneously the significance of the single investigated factors can be established. This method allows for elimination of subjective factors in evaluation of investigations, which could not be said about the method of determination of weights or coefficients of significance.

Medico-geographic modeling could be presented, as a system of operations by the use of maps, directed on creation of new information of the object of investigations—the anthropo-ecological system. Using a series of maps of narrow specialty, synthetic maps can be constructed that make possible the identification of areas creating the defined potential of health risk caused by environmental factors.

On each stage of solution of the problem in medico-geographic investigations, there should be deep analysis of the obtained results, because only the multiple analysis of numerous facts in complex approach differs medical geography from related research areas, such as epidemiology.

Investigations in the area of medical geography demand constant and systematic development of information systems on natural, environmental, and socioeconomic conditions as well as on health status of the population.

Increased effectiveness of medico-geographic investigations directed to environmental health risk assessment is, in part, attributed to application of computer techniques on environmental and socioeconomic factors and health status of the population.

Already existing tools enable the creation of special medico-geographic maps, which, in turn, are used for detailed analysis of cause-and-effect relationships.

As an illustration of this general approach, maps of Łódź voivodship could be used for evaluation of this district for health risk assessment related to ambient air contamination (see Figures 1 through 4).

FIGURE 1: ANNUAL SULFUR DIOXIDE CONCENTRATION (in µg/m³), ŁODZ VOIVODSHIP (DISTRICT), 1989

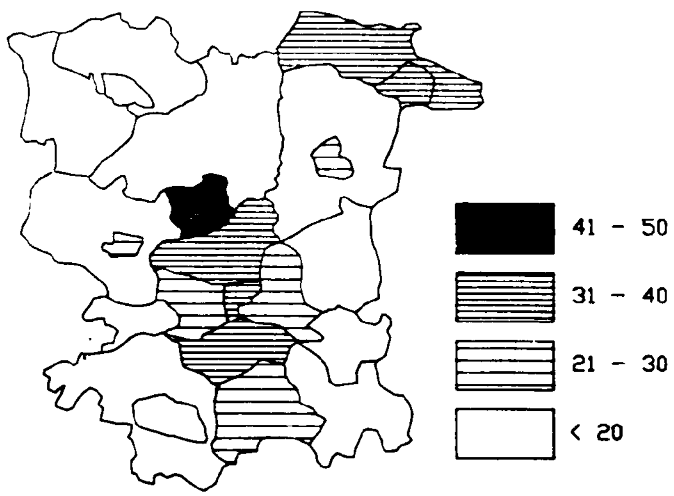


FIGURE 2: ANNUAL SMOKE CONCENTRATION (in µg/m³), ŁODZ VOIVODSHIP (DISTRICT), 1989

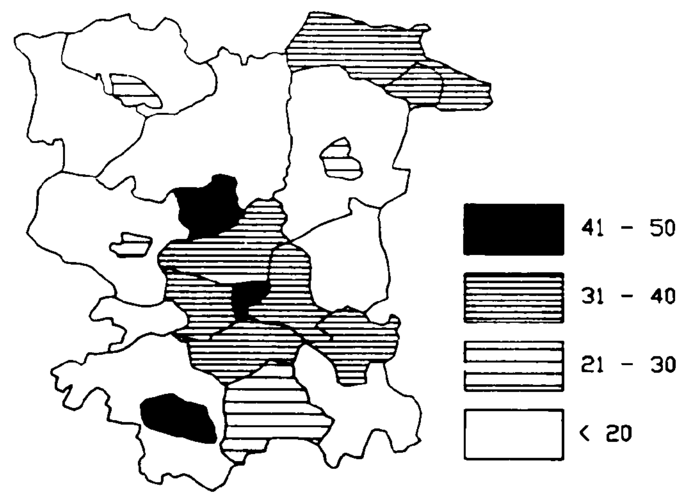


FIGURE 3: ANNUAL DUST DEPOSITION (in g/m²), ŁODZ VOIVODSHIP (DISTRICT), 1989

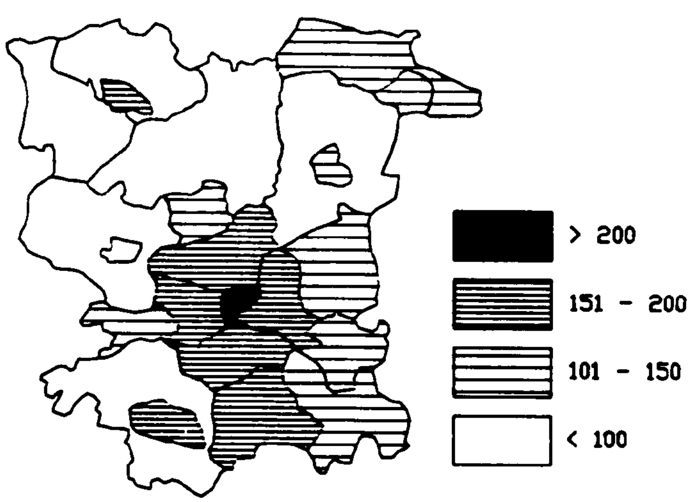
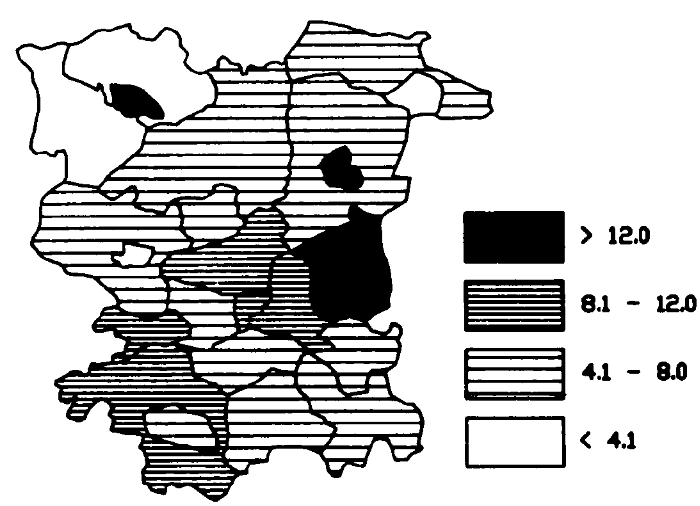


FIGURE 4: STANDARDIZED LUNG CANCER MORTALITY RATES (PER 10,000), MALES, ŁODZ VOIVODSHIP (DISTRICT), 1989



PART THREE: METHODS AND APPLICATIONS

SECTION SEVEN: STUDIES OF ENVIRONMENTAL CONTAMINATION AND HEALTH

Top row: Halina Brown, Eugene Antipenko, Wieslaw Jedrychowski, and Eugen Gurzau.
Bottom row: Olga Kékesi, Vladimir Lupandin, and Leonard Dobrovolsky.
Pictured Earlier: Jerome J. Wesolowski.

INDUSTRIAL DEVELOPMENT AND CANCER IN POLAND[*]

Presented by Halina Szejnwald Brown
Clark University
Worcester, Massachusetts, USA

Since 1945, Poland has undergone a fundamental and irreversible transition from a primarily agricultural economy to one heavily dependent on industrial production and energy generation. The industrialization was achieved at a substantial human and environmental price, which included dramatic growth in consumption of cigarettes, alcohol, and animal fats, as well as increased exposure to occupational hazards. The most visible and measurable adverse effect of Poland's intense industrialization has been environmental degradation, especially air and water pollution.

As shown in Figure 1, air pollution is higher in the more industrialized southwestern part of the country, from both domestic and foreign sources. Poland's industrial development has been accompanied by distinct trends in mortality. Following a dramatic increase in the average life expectancy during the 1950s, 1960s, and early 1970s, the rate of increase markedly declined, and by the late 1980s the rate declined among some groups, such as middle-aged men. Circulatory disease and cancer—the two most common causes of death—largely explain the life-expectancy statistics: between 1950 and 1985, cancer mortality among middle-aged men increased by approximately 2 percent per year; mortality from circulatory diseases during this period almost tripled (1).

Figure 1:
Sulfur Deposition and Concentration ($\mu g/m^3$) in Poland in the Mid-1980s

---

* Authors of this paper are Halina Szejnwald Brown and Robert L. Goble. The authors acknowledge the National Council for Soviet and East European Research for support of this research, and thank Professor Henryk Kirschner, Institute of Social Medicine, Warsaw Medical Academy, for providing access to the health and environmental statistics in Poland, and Dr. Clark Heath, American Cancer Society, for providing unpublished cancer mortality statistics from the Cancer Prevention Study II.

In this paper, we present the initial results of a project undertaken in order to (a) identify key factors that could explain declining life expectancy and increasing cancer mortality in Poland, and (b) test the hypothesis that pollution is a major contributor to the spatial and temporal trends in lung cancer.

Conceptual and Methodological Approach: In the first stage of the analysis, the expected district-specific mortality rates from lung and pancreatic cancers, both age-standardized to the same fictitious world population, were estimated, and compared with the corresponding observed rates. The portion of observed mortality that would exceed the calculated rate was assumed to include the effects of industrialization, if such exist.

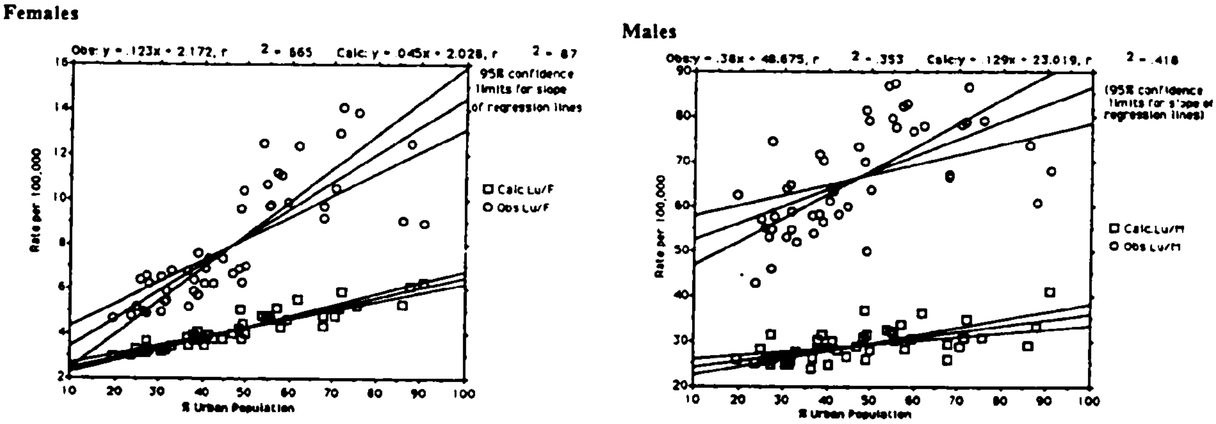
Starting with the premise that cigarette smoking is the major risk factor in lung cancer and an important one in pancreatic cancer, the calculated mortality rate is a sum of rates among smokers, former smokers, and nonsmokers, weighted by their proportions in the population. Since there are large differences in the prevalence and degree of smoking between males and females, and between urban and rural populations, the total mortality rate is the weighted sum of the rates contributed by each group. In the absence of known cancer rates among smokers, nonsmokers, and former smokers in Poland, the rates established through the American Cancer Society (ACS)-sponsored Cancer Prevention Study were used (3).

The relative risk among continuing smokers was calculated separately for men and women in urban and rural areas, and for each voivodship, based on their corresponding average smoking rates (number of cigarettes per person per day). The relative risk among former smokers was assumed to be 0.4 of that of continuing smokers, irrespective of smoking rate and of number of years since cessation (4). The smoking rates were estimated from the data generated by random population surveys and from sales statistics in Poland, and additionally checked for consistency with each other. The quantitative relationship between smoking rate and cancer mortality rate derived from the ACS study formed the basis for the calculations of the relative risk among continuing smokers.

The presumed latency period was predetermined by the time interval covered by the available data: the earliest reliable smoking statistics extend back to 1975, while the most recent district-specific cancer mortality statistics are from the 1985-1988 period. This period may be too short, for in traditional observations of national trends in lung cancer mortality following trends in cigarette consumption the observed lag time has generally been between 20 and 30 years. On the other hand, if a 10-year latency period is assumed, the per-capita annual consumption of cigarettes in Poland gives the best statistical correlation with mortality rates from lung cancer, for both men and women (5).

In order to further explain the spatial heterogeneity of cancer rates in Poland and the possible origins of the "unexplained" fraction of cancer, in the second part of analysis the calculated and observed rates of lung cancer and pancreatic cancer were plotted against district-specific percentages of urban population, and examined for geographic trends.

Figure 3: Observed and Calculated Lung Cancer Rates vs. Urbanization of Population



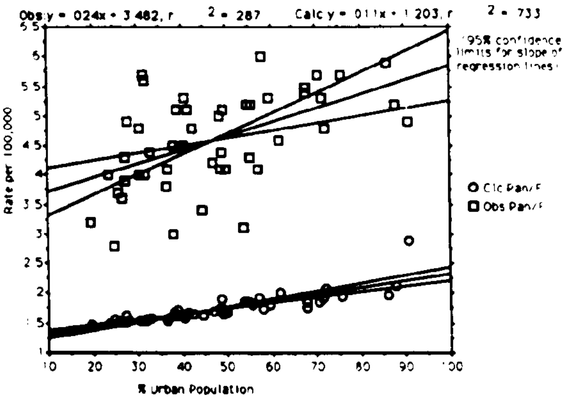
Results: Figure 3 shows that degree of urbanization is a good predictor of estimated lung cancer rates. A similar correlation was obtained for pancreatic cancer. This is not surprising because district-specific cigarette consumption is associated with the degree of urbanization, especially for women for whom urbanization is a key determinant of smoking prevalence.

Figure 3 also shows that the estimated rates significantly underestimated the observed rates, on the average 60 percent for women and 37 percent for men. Several plausible explanations for the apparent underestimates are possible: risk factors other than smoking, such as ambient environmental pollution or workplace exposures, may play significant roles. Polish cigarettes, which have until recently been mostly unfiltered and are made of heavy-in-tar-content black tobacco, may have higher carcinogenic potency than American cigarettes made of "blond" tobacco. We may also be underestimating the effects of environmental tobacco smoke, especially on rural women, who are most likely to be nonsmokers and married to smokers—although the magnitude of this effect, we believe, would be relatively small.

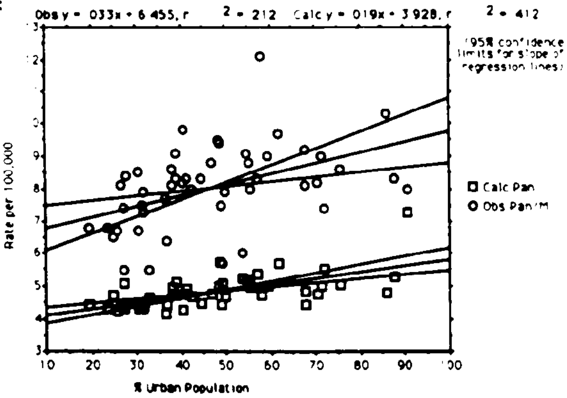
Interestingly, in all cases, a correlation is also seen between observed rates and degree of urbanization. This may be due to the underestimation of the potency of Polish cigarettes, the magnitude of which would increase proportionately to the calculated rate. Alternatively, it may additionally reflect other factors related to the degree of urbanization, such as pollution, occupational exposures, and other hazards. The convergence of the calculated and observed regression lines for female lung cancer at zero urbanization, at a level corresponding to the rate among nonsmokers, is consistent with both explanations. In a hypothetical, entirely rural district, only about 7 percent of women are smokers; with the smoking effect small and no effect of urbanization and industrialization, the factors responsible for the gap between the calculated and observed rates are insignificant, so that the lung cancer rate in this voivodship closely

Figure 4: Observed and Calculated Pancreatic Cancer Rates vs. Percent Urban Population

a. Females:



b. Males:



approximates that for nonsmokers. The coherence of these observations gives additional credence to the methodology used in this analysis.

In contrast to females, the prevalence of male smokers in a hypothetical, entirely rural voivodship is approximately 50 percent, so the effect of smoking—including the difference between Polish and American cigarettes—is present even at this level. Assuming that at this level other factors level other factors that contribute to the correlation between urbanization and cancer and contribute to the discrepancy between calculated and observed rates are nonexistent, then the difference between observed and calculated rates can be entirely attributed to the potencies of the two types of cigarettes. Since the prevalence of smoking among urban and rural males is similar, the ratio of observed to calculated rates—approximately 2—is the measure of that potency ratio.

In order to examine the possible effect of factors other than cigarette smoking on cancer rate, district-specific rates were calculated using the potency factor of 2. The resulting difference between observed (O) and calculated (C) rates, as well as the O/C ratio, were plotted against degree of urbanization, percent of population employed in industry, and annual particulate emissions from heavy industry per unit surface area (tons/km^2). The latter two variables are rather indirect measures of population exposure to occupational and environmental pollutants and should, therefore, not be overinterpreted.

As shown in Figure 4 (for women), degree of urbanization can partially explain the variability in O-C rates and the O/C ratio among districts, although the correlation is affected by a few significant outliers. Similar results were obtained for men as well, as when "O-C" rather than "O/C" was used as a dependent variable. It appears that percent urban population, while related to the "excess" cancer mortality, is not a direct explanatory variable. In contrast, no correlation was observed between cancer and either percentage employed in industry or air pollution index. For pancreatic cancer, no correlation between O-C ratio or the O/C ratio and any of the above variables could be observed. The ratio of the average O/C ratio for lung cancer for the nine most urban and the nine most rural counties—which we term "urban factor" in lung cancer—was 1.2 for men and 1.4 for women.

Discussion and Conclusions: The excess rate of cancer among urban dwellers, relative to their rural counterparts, was observed as early as the 1950s in other industrialized countries. There is considerable agreement, though by no means consensus, that this excess, which persists after correcting for smoking and is known as the "urban factor" in lung cancer, can be at least partially attributed to air pollution. Estimates of the contribution of air pollution to lung cancer in urban areas, based on different methodological and conceptual approaches, and all saddled with considerable uncertainty, have ranged from 2 to over 10 percent.

Our initial estimates of the magnitude of the urban factor in Poland—1.2 and 1.4 for men and women, respectively—are consistent with earlier observations in the United States and other industrial countries. Two very different interpretations are evident. From one perspective, it appears that if technological development and associated environmental degradation were major factors in population cancer, a larger magnitude of the urban factor would be observed. On the other hand, considering the relatively short time that has passed since Poland departed from its predominantly rural character (the process began only four decades before), and given a slow increase in cancer mortality in a population exposed to any environmental and social stimuli, this is a significant difference indeed.

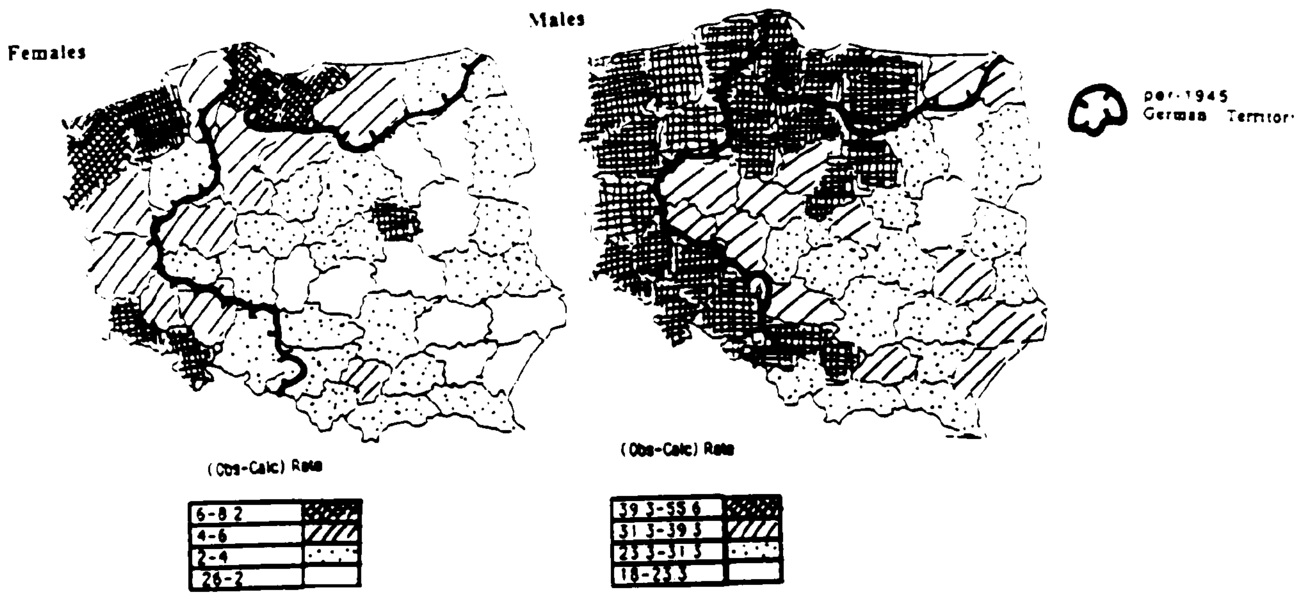
To what extent can the urban factor in Poland be attributed specifically to air pollution? Two lines of evidence suggest a possibly important contribution from air pollution.

(1) After correcting for smoking, the urban-rural difference can be observed in the lung cancer mortality rate, despite significant variability in the data, but not for that of pancreatic cancer. This is consistent with the biological hypothesis that the lung is the primary target organ for the effects of airborne carcinogens.

The absence of the urban factor in pancreatic cancer must be interpreted with caution, however, because it may be only a statistical phenomenon due to the lower statistical power of the pancreatic mortality data. It will be helpful to perform a similar analysis for kidney and bladder cancers which, like pancreatic cancer, are also induced by cigarette smoking, but presumably are not significantly affected by air pollution.

(2) Little relationship was found between urbanization and mortality from stomach cancer, which is presumably not affected significantly by either air pollution or smoking.

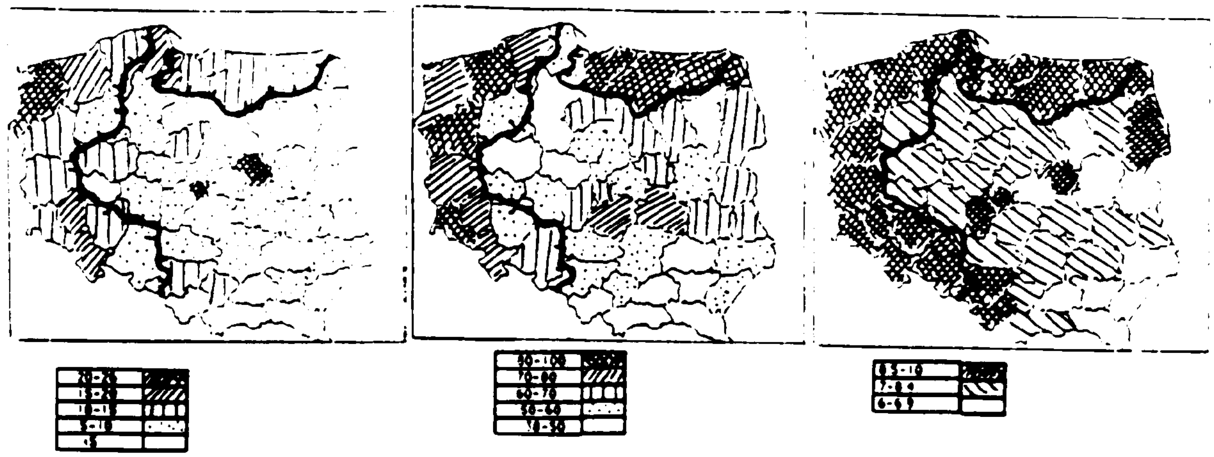
Figure 5: Geographic Distribution of the "Unexplained" Fraction of Lung Cancer in Poland (O-C)



On the other hand, no significant correlations were found either with percentage employment in industry or with the spatial density of particulate emission rates from heavy industry in individual counties. Although these are rather poor indicators of actual population exposure to carcinogenic air pollutants in ambient air and in the workplace, we would expect some measurable relationship to emerge from the analysis. It would be illuminating to test the correlation between cancer and direct human exposure measures such as average concentrations of airborne particulate matter.

Another indication that air pollution may not play a significant role in lung cancer and mortality in Poland comes from the geographic distribution of the districts with the highest "unexplained" fraction of lung cancer. While these tend to be located in the western part of the country, there is poor overlap with the districts with the most extensive environmental degradation. In fact, the map thus created (Figure 5) outlines surprisingly well the Polish territories that were annexed from Germany in 1945.

Figure 6: Geographic Distribution of Divorce Rate, Crime Rate, and Alcohol Consumption in Poland



Divorce Rate per 10,000 people per year.

Crime Rate Convictions per 10,000 people per year.

Alcohol Consumption Rate Liters of 100% alcohol per person per year.

Halik analyzed spatial distribution of the intensity of social pathologies, namely alcohol abuse, crime rate, and divorce rate (the latter as a measure of general social stress) in Poland, and found that the leading districts were consistently located in the post-German territories (Figure 6) (6). He hypothesized that the population living in these areas, largely migrants from the East during the post-war resettlement period, continues after several decades to experience the aftershock of the uprooting. The hypothesis is consistent with findings by Rychtarikova that spatial distribution of life expectancy in Czechoslovakia inversely correlates with divorce rate and percentage of population being gypsies, not with ambient concentrations of air pollutants (7). The hypothesis that social factors other than environmental and occupational pollution largely explain the lung cancer mortality not accounted for by smoking—possibly in a synergistic or cocarcinogenic mode with smoking and/or minor pollution effects—needs to be rigorously tested.

In summary, no strong evidence has emerged in support of an association between pollution and lung cancer in Poland. The results show that percent of urban population—and not employment in polluting industries or emission of air pollutants—can partially explain geographic variations in the urban factor in lung cancer, though the relationship must be viewed as tentative. The magnitude of that urban factor in lung cancer is in the range of 1.2 for men and 1.4 for women. The districts with the highest fraction of "unexplained" lung cancer seem to correlate with the regions of high alcoholism, divorce, and crime rates, and other social pathologies, and are not consistently located in the areas of either high air pollution, percent of population employed in industry, or the highest air emission factors in Poland. Furthermore, these districts with high lung cancer rates also tend to be located in territories that were annexed from Germany at the end of World War II, which are also among the most urbanized areas of Poland.

Based on these results, and echoing the work of others in Poland, we hypothesize that the social uprooting associated with major population resettlement in Poland during the post-war years may have produced living conditions that were adverse to health, and that indicators of social pathologies—not those of pollution, occupation, or other technological hazards—may best explain the geographic patterns of cancer in Poland. This hypothesis will be tested through follow-up studies.

REFERENCES

1. Zatonski, W. and Tyczynski, J. 1990. "Cancer in Poland. Epidemiological Situation," in Cancer Prevention. Vital Statistics to Intervention, Zatonski, W., Boyle, P., and Tycznski, J., eds., Proceedings of the International Conference, 12-14 October, 1988. Warsaw: PA Interpress.

2. Tyczynski, J. 1990. Geography of Selected Malignant Neoplasms in Poland. Temporal Trends, Doctoral Dissertation, The Maria Sklodouska-Curie Memorial Cancer Center and Institute of Oncology, Warsaw. (in Polish)

3. Heath, C. American Cancer Society. Personal Communications.

4. Brown, C.C. and Chu, K. 1987. Use of Multistage Models to Infer Stage Affected by Carcinogenic Exposure: Example of Lung Cancer and Cigarette Smoking, J. Chronic Dis. 40, Suppl. 2: 171S-179S.

5. Zatonski, W., Okolski, M., Kocot, K., Przewozniak, K., and Tycznski, J. 1990. Demographical Consequences of Smoking in Poland: Tobacco Smoking and Malignant Neoplasms, Expert Evaluation, The Maria Sklodowska-Curie Memorial Cancer Center and Institute of Oncology, Warsaw. (in Polish)

6. Halik, J., 1992. Institute of Social Medicine, Warsaw Medical Academy, Warsaw. Personal Communications.

7. Rychtarikowa, J. 1991. Mortality and Air Pollution in Czechoslovakia, paper presented at the International Symposium on Air Pollution in Central and Eastern Europe, Frydek-Mistek, Northern Moravia, June 14-19, 1991.

PREMATURE DEATHS DUE TO TOBACCO USE: REMARKS ON ACCEPTANCE OF HONORARY MEMBERSHIP IN THE POLISH SOCIETY OF HYGIENE

Jerome J. Wesolowski
California Department of Health Services,
University of California, Berkeley,
and United States Committee on Poland's Environment
Berkeley, California, USA

It is important to note that the reduction of premature deaths brought about by even the most intelligent environmental policies is insignificant when compared to the number of premature deaths caused by one voluntary risk, namely the risk incurred through the use of tobacco. It is now abundantly clear that tobacco is the leading cause of premature deaths in developed countries. In fact, about one-fifth of the people now living in developed countries — about a quarter of a billion out of one-and-a-quarter billion — will eventually be killed by tobacco, losing an average of 15 years of life expectancy per death. This is not careless speculation but is the result of careful scientific analysis. Just a few weeks before this symposium, the world renowned epidemiologist Richard Peto and his colleagues proclaimed these conclusions in the highly respected medical journal Lancet (1). Unfortunately, Poland was singled out in the article. According to Peto and his colleagues: "At the projected 1995 death rates, about half of all Polish males aged 35 could expect to die before 70, with about half of these Polish deaths attributed to tobacco." This is a staggering finding.

This terrible statistic speaks to the importance of strengthening anti-smoking programs already underway in Poland and other Central and Eastern European countries. It also speaks to the importance of integrating traditional public health programs with environmental programs, lest we lose sight of what is killing whom, and in what numbers.

I compliment the organizers of this conference for having the foresight to begin this integration, and I thank the Polish Society of Hygiene for choosing this symposium to honor me with this award.

REFERENCE

1. Peto, R., Lopez, A.D., Boreham, J., Thun, M., and Heath, C., Jr. 1992. Mortality from Tobacco in Developed Countries: Indirect Estimation from National Vital Statistics. The Lancet 339:1268-1278.

MONITORING OF SPONTANEOUS ABORTIONS AND CONGENITAL ANOMALIES IN CITIES WITH HIGH LEVELS OF AMBIENT AIR POLLUTANTS IN UKRAINE

Eugene Antipenko
Ukrainian State Medical Center for Environmental Health
Kiev, Ukraine

Although adverse health effects from environmental pollution have been demonstrated, quantitative evaluation of the mutation rate in humans caused by human-made factors has not been performed. If the mutation rate were to double, disastrous effects for human heredity might ensue. The level of ionizing radiation that doubles the human mutation rate is nearly 100 Biological Equivalents in Roentgens (BERs) over 30 years. The Club of Rome experts' opinion is that this level of radiation could occur on the earth's surface as the result of a nuclear world war.

Has the genetic danger caused by chemical contamination in some regions of Ukraine really drawn us nearer to this fatal boundary? Our work endeavors to answer this question.

From 1984 to 1987, genetic monitoring was performed in two of the most polluted Ukrainian cities, Mariupol and Zaporozhye. They are situated in the Donetsk-Pridneprovsk economic region and are dominated by the metallurgic industry. Relatively clean Simferopol was chosen as a control city.

From 1982 to 1987, industrial enterprises and traffic annually emitted about 920,000 tons of pollutants into the air in Mariupol, 415,000 tons in Zaporozhye, and 130,000 tons in Simferopol. Stationary sources emit into the ambient air of Mariupol about 50 different substances; 15 of them display mutagenic activity. The gross emission of these substances in 1987 in Mariupol was about 32,000 tons—1.5 times higher than in Zaporozhye. Each Mariupol resident over 30 years (an average reproductive age) received about 2 tons of mutagens; taking into account embryotropic substances, this amount was more than 37 tons. These parameters for Zaporozhye were about 40 percent and 15 percent as much, respectively. Because of concerns about these findings, an epidemiological investigation of spontaneous abortions and congenital anomalies was performed in Mariupol, Zaporozhye, and Simferopol.

SPONTANEOUS ABORTIONS INVESTIGATION

Spontaneous abortions (SAs) are a good index of the genetic consequences of environmental pollution because mutations are thought to be a major causative factor and because their occurrence is great compared to other genetic events. A cytogenetic study of SAs shows that almost half are due to a mutation in the parent sex cells or fertilized ovum at early developmental stages. And in 95 to 99 percent of cases there are new genomic mutations; this is especially important, because determination of the frequency of new mutations due to the environmental pollution represents the essence of genetic monitoring. The average SA frequency of 15 percent of all pregnancy outcomes, according to World Health Organization data, is almost 400 times the frequency of congenital anomalies of a dominant heredity pattern (which are recommended for a genetic monitoring as a sentinel phenotype) (1). Another important advantage of using SAs for genetic monitoring is their high sensitivity to "environmental state optimization." Thus, in connection with ionizing radiation exposure termination, for identifying a 50 percent reduction in SAs, 30 years are necessary, while for revealing the same frequency reduction of dominant and X-linked congenital anomalies, 90 years are necessary. Chromosome anomalies at the early stages of pregnancy contribute to SAs more than at the later stages. Therefore, a search should be undertaken for the role of environmental mutagens in the etiology of SAs and the increased occurrence of SAs. Application of methods to determine the adverse effects of hereditary factors on the population is impossible. However, a contemporary mathematical apparatus titled statusmetry (2) can help determine SAs caused by mutations. Statusmetry enables us to separate out SAs probably not explainable by known causes. Thus, the differences in the frequency of SAs of unknown cause identified in the two polluted cities studied will reflect different rates of injury to the genetic apparatus of sex cells induced by external environmental exposure.

Methods: In all gynecological hospitals in Mariupol, Zaporozhye, and Simferopol, physicians in charge completed questionnaires for each SA case identified by our specialists. The questionnaire included a list of almost all known SA causes and conditions: parents' health status, occupation, and demographic and social information. To try to achieve uniformity, instructive consultations

Square in Old Town district in Warsaw.

TABLE 1: DYNAMICS OF SPONTANEOUS ABORTIONS PER 100 DESIRED PREGNANCIES IN EACH OF THE THREE SITES			
	Spontaneous Abortions		
Year	Mariupol	Zaporozhye	Simferopol
1981	26.5	23.7	11.9
1982	28.5	20.8	11.1
1983	24.7	20.8	8.6
1984	23.9	21.4	8.3
1985	21.1	15.9	13.6
1986	21.8	19.4	12.5
1987	24.0	15.8	14.1
1988	23.5	16.4	10.4

were held with obstetrician-gynecologists. Twice a year, adequacy and objectivity of completed questionnaires was checked. There were 4,003 cases registered in Mariupol, 3,790 in Zaporozhye, and 759 in Simferopol. In addition, 827 control forms were completed in these three cities for normal birth outcomes. No women pregnant for the first time and no women over age 35 years were included in the study.

Results: The average SA frequency in desired pregnancies in Mariupol and Zaporozhye was far higher than in Simferopol (Table 1). Statusmetric analysis showed that the frequency of SAs possibly due to mutations induced by environmental pollution in Mariupol and Zaporozhye was 2.7 to 3.3 times that in Simferopol.

The average duration of residence of women with SAs was 20.3 to 20.6 years in Mariupol and Zaporozhye, and 18.5 years in Simferopol. For the male partners of these women, average duration of residence was 22.1 years in Mariupol, 22.3 years in Zaporozhye, and 18.9 years in Simferopol.

CONGENITAL ANOMALIES INVESTIGATION

An epidemiological investigation was performed of the following 16 congenital anomalies (CAs), if they were noted during the first year of life: Down's syndrome, other multiple congenital anomalies, anencephaly, hydrocephaly, spina bifida, encephalocele, cleft lip and/or cleft palate, inguinal hernia, congenital esophageal atresia, congenital pyloric stenosis, anorectal atresia, hypospadias, undescended testicle, polydactyly, syndactyly, and reduction deformities of limbs.

Congenital dislocation of hip and clubfoot were not included because of registration problems in Zaporozhye. The choice of CAs for investigation was in accordance with the international system (3).

Methods: For each case of a child with a CA, a special questionnaire was completed by maternity hospitals and children's polyclinic physicians, including information obtained from mothers. Included were almost all known causes and conditions of CA formation. In a similar way, information about healthy and mature newborns was obtained. Evaluation of control newborns included their Apgar scores. Analyzed were data for 777 children with CAs (270 in Mariupol, 266 in Zaporozhye, and 241 in Simferopol) and for 826 control children (300 in Mariupol, 240 in Zaporozhye, and 286 in Simferopol). In each city, the number of CAs found in primary documents was compared twice a year. Duplicates were excluded.

Results: According to the official data, the median annual frequency of all CAs registered in maternity hospitals was 20.2 in Mariupol, 11.5 in Zaporozhye, and 7.7 in Simferopol per 1,000 live births. For 16 specifically studied CAs, the rate in Mariupol was 3.1 times, and the rate in Zaporozhye was 2.3 times more, than in Simferopol. From single-factorial analyses data, the essential causes of CA in Mariupol and Zaporozhye were found to be mothers' infectious diseases during pregnancy, especially at the early stages, and occupational risk. In Mariupol, fathers' occupational risk was also found to be one of the chief factors. Changes in mutation rate were evaluated according to CA frequency caused by new mutations. It was assumed that CAs caused by new mutations were mostly concentrated among CAs of uncertain etiology. Differences in the frequency of these indefinite-etiology anomalies found in Mariupol and Zaporozhye, if similar to CA differences, might have served as indirect testimony to the various degrees of genetic effects, especially if these differences coincided with the degree of environmental pollution in these cities. In Simferopol, these indefinite-etiology CAs accounted for 25 percent of all CAs—similar to rates cited in the literature. In Mariupol and Zaporozhye, these CAs of indefinite-etiology were 1.5 and 1.2 times higher, respectively.

The frequency of CAs of dominant type and X-linked type in Mariupol was 3.1 times higher than that in Simferopol. The same tendency was observed with multiple CAs: the rate of multiple congenital anomalies in Mariupol was 4.2, in Zaporozhye 3.4, and in Simferopol 1.6 per 1,000 births. At the same time, no difference was noted in the frequency of multifactorial CAs, such as anencephaly, congenital pyloric stenosis, and congenital esophageal atresia, or those of recessive type, such as anorectal atresia and girls' hydrocephaly. The number of CAs of dominant type and X-linked type, and the number of CAs in different cities, is shown in Table 2.

The rate of dominant CAs attributed to new mutations was estimated to be 0.17 to 0.47 per 1,000 births in Simferopol and 0.45 to 0.95 in Mariupol (as compared to 0.35 in Simferopol and 0.35 in Hungary in 1980-1985) (4). Evaluation of the frequency of new mutations is shown in Table 3. According to the literature, the frequency of new autosome-dominant mutations in various populations varies within the limits from 10^{-4} to 10^{-6}, and the frequency of X-linked mutations from 10^{-3} to 10^{-4} per gene per generation.

TABLE 2: QUANTITY OF CONGENITAL ANOMALIES (CAs), CHOSEN FOR GENETIC MONITORING							
City	Number of births	All CAs		CAs of dominant and x-linked type*		Multiple CAs including Down's syndrome	
		Number	Rate**	Number	Rate**	Number	Rate**
Simferopol	17,515	68	3.8	12	0.7	28	1.6
Zaporozhye	23,036	204	8.8	23	1.0	79	3.4
Mariupol	13,754	61	11.7	30	2.2	68	4.2

* Polydactyly, syndactyly, reduction deformities of limbs, hydrocephaly (boys only)
** Rate per 1000 births

TABLE 3: AVERAGE MUTABILITY (PER GENE PER GENERATION)			
City	Mutation types		
	Autosome-dominant		X-linked
	Extreme values	Central values	
Simferopol	9.0×10^{-5}, 35×10^{-4}	1.45×10^{-4}	1.0×10^{-4}
Mariupol	2.2×10^{-4}, 7×10^{-4}	3.0×10^{-4}	3.0×10^{-4}

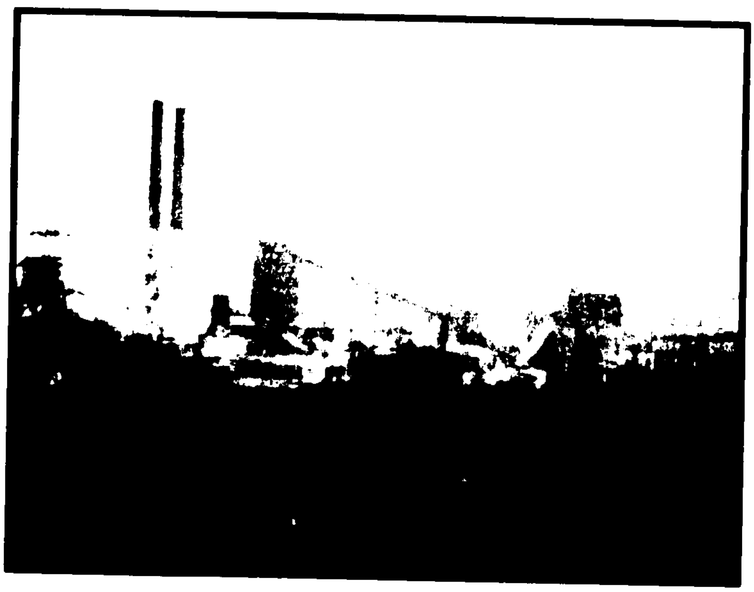
CONCLUSIONS

The evaluation of the significance of the differences found is an important stage of genetic monitoring. As far back as the 1970s, American scientists suggested to express the quantitative evaluation of mutations caused by the influence of chemical mutagens in Roentgen Equivalents in Man (REMs)(5). The application of radiological direct and doubling dose methods provided an opportunity to evaluate the consequences of environmental chemical contamination in REMs. It was taken into consideration that the fathers' irradiation in the dose of 10^{-2} Gy led to an increase in the frequency of SAs due to reciprocal translocations of 11 to 55 cases per 1 million of pregnancies (6).

The calculations presented permit making a conclusion that the genetic consequences of environmental chemical pollution in Mariupol were equivalent to the radiation at a dose of nearly 80 REMs per 30 years (Tables 4 and 5).

<table>
<tr><th colspan="5">TABLE 4: CONSEQUENCES OF ENVIRONMENTAL CHEMICAL POLLUTION IN MARIUPOL IN BER (INVESTIGATION OF CONGENITAL ANOMALIES, DIRECT METHOD)</th></tr>
<tr><th rowspan="2">Expected Frequency of CA after the Irradiation of Fathers in the Dose of 10^{-2} Gy (per 10^6 Live Births)</th><th colspan="2">Observed Frequency of CA in the First Generation (per 10^6 Live Births)</th><th rowspan="2">Excess CA in Mariupol Relative to Simferopol</th><th rowspan="2">Consequences of Chemical Contamination, Equal to the Effect of Irradiation, BER for 30 years</th></tr>
<tr><th>Simferopol</th><th>Mariupol</th></tr>
<tr><td>2.0 Skeleton Congenital Defects (Dominant Mutations)</td><td>280*
(170-470)</td><td>650*
(450-950)</td><td>370</td><td>185
304*</td></tr>
<tr><td>2.2 Skeleton Congenital Defects (Dominant Mutations and Hydrocephaly) (X-linked Mutations)</td><td>500*
(370-670)</td><td>1600*
(1350-1850)</td><td>1100</td><td>500</td></tr>
</table>

* Central Estimate



Steel plant in Mariupol.

TABLE 5: CONSEQUENCES OF ENVIRONMENTAL CHEMICAL POLLUTION IN MARIUPOL IN BER (INVESTIGATION OF CONGENITAL ANOMALIES, DOUBLING DOSE METHOD)			
Number of New Skeleton and X-linked Mutations (per 10^6 Births)		Mariupol/Simferopol	Consequence of Chemical Contamination is Equal to the Effect of Irradiation, BER for 30 Years
Simferopol	Mariupol		
370	1350	3.6	180

Analogously, genetic effects due to chemical atmospheric air pollution for Zaporozhye were calculated as being equivalent to population radiation at a dose of 50 REMs per 30 years.

Thus, based on results of our investigations, it was determined that the total number of SAs in the two polluted cities (both early-term SAs as well as SAs of probably mutagenic origin that were identified by the way of a multifactorial analysis) were significantly higher than in the relatively clean comparison town.

As for the estimation of the rate of CAs, we proceeded from the data, according to which the birth frequency of children with skeletal CAs caused by dominant mutations in the first generation, after the irradiation of fathers with a dose of 10^{-2} Gy, was 2.0 per 10^6 newborns, compared to 0.2 per 10^6 newborns for X-linked mutations (6). When applying the doubling dose method, it was taken into account that the dose that doubled the frequency of spontaneous mutations was equal to 100 REMs per 30 years (7). The frequency of the investigated events in Simferopol served as a reflection of the level of spontaneous mutations in both the direct and doubling dose methods.

In Mariupol, the CA frequency turned out to be equivalent to the chronic influence of ionizing radiation for 30 years in the dose of 304 REMs (direct method) and 180 REMs (doubling dose method); the central value was 230 REMs. (These calculations, however, are given only in comparison with radiation-induced skeletal mutations.) The genetic consequence values for chemical pollution, calculated in REMs, are 3 to 4 times higher for CAs (gene mutations) than those of SAs (chromosomal mutations). This is in accordance with experimental data showing frequencies of up to 5 times greater for gene mutations than for chromosomal ones.

The results of quantitative evaluation concerning the genetic consequences of environmental chemical pollution in BERs, for both SAs and CAs, are shown in Tables 6 and 7. They support an association between genetic pathology and total emission of air pollution. This association exists between air pollutant emissions and the mutation rate. The annual output of air pollutants in Mariupol is 2.21 times higher than in Zaporozhye. The frequency of dominant and X-linked

CAs and the frequency of new skeleton mutations in Mariupol exceed the rate in Zaporozhye by 2.20 and 2.24 times, respectively.

Thus, the genetic consequences of environmental chemical pollution in two Ukraine cities have come close to the critical level (100 BERs for 30 years)—and they even may have overcome it. According to conclusions of International Chernobyl Project experts, the total expected human radiation dose (both external and internal for the period of 70 years: 1986-2056) concerning those who live in seven of the most polluted Ukraine residential territories due to the Chernobyl accident will only be 8 to 10 REMs.

Differences in the mutation rate in the study cities are in accordance with dynamics of demographic processes. According to the Ukrainian Academy of Sciences Economy Institute Demographic Department's data, the natural increase of population coefficients in 1985-1987 compared to 1978-1980 increased by 23 percent in Simferopol, but decreased by 15 percent in Zaporozhye and 19 percent in Mariupol, respectively.

Thus, taking into account our tendency to estimate scientific results while considering economical and political factors, I would like to compare the damage to the health of the people of Mariupol due to environmental pollution with the cost of the metallurgic complex there—both in total cost as well as the cost of the work of cleaning installations in the city.

Factory in industrial area in Zaporozhye.

TABLE 6: RELATIONSHIP BETWEEN MUTAGENIC EMISSION INTO ATMOSPHERE AND GENETIC CONSEQUENCES OF ENVIRONMENTAL POLLUTION (MARIUPOL/ZAPOROZHYE)		
Annual Mutagenic Emission (tons)	SA Frequency before 6th Week of Pregnancy (%)	Genetic Consequences of Environmental Chemical Pollution in BER
$\frac{31717}{20272} = 1.6$	$\frac{32.4}{20.1} = 1.6$	$\frac{80}{50} = 1.6$

TABLE 7: ATMOSPHERIC POLLUTANT EMISSION AND FREQUENCIES OF SOME CONGENITAL ANOMALIES (MARIUPOL/ZAPOROZHYE)		
Annual Total Emission of Atmospheric Pollutants	Frequencies (per 10^3 Births)	
	Dominant and X-linked CA	New Skeleton Mutations
$\frac{920 \times 10^3 \text{ tons}}{415 \times 10^3 \text{ tons}} = 2.21$	$\frac{2.2}{1.0} = 2.20$	$\frac{0.65}{0.29} = 2.24$

In 1975, Committee 17 of the United States National Academy of Sciences proposed to evaluate in dollars the detrimental effect on the population due to ionizing radiation exposure. This approach was also recommended for the assessment of economic damage due to chemical mutagens. If we assume that the cost of health loss due to one person irradiated with a dose of 1 REM varies, based on Committee 17 experts' opinion, in the range of $12 to $120, then the cost of health loss for the whole population of Mariupol due to environmental chemical pollution would be between $1 billion and $10 billion. Meanwhile, the entire cost of Mariupol's metallurgic complex is 1.6 billion rubles. In 1989, the Complex Project on Air and Water Pools Protection in the City of Mariupol was established. Its cost was nearly 800 million rubles; the USSR Soviet of Ministers rejected its realization.

Consequently, the damage to the health of Mariupol's population as a result of environmental pollution is greater than the cost of its whole metallurgic complex, including the cost of the reconstructive cleaning installations.

Thus, considering only one region, the results of short-sighted policy in the field of ecology are quite obvious. But, maybe just in this case, would it be more correct to speak about the absence of any policy in solving this problem?

REFERENCES

1. Environmental Health Criteria 46. Guidelines for the Study of Genetic Effects in Human Population. Geneva, 1985, p. 126.
2. Razoryonov G.I., and Poddubsky G.A. (1985) Automatized selection of indicators at the objects classification. Zavodskaya Laboratory. 7, 48-50. (In Russian).
3. International Clearinghouse for Birth Defects Monitoring Systems. Annual report, 1984 (1986). Government printer: Wellington, p. 66.
4. Czeizel A. (1989) Population surveillance of sentinel anomalies. Mutation Research. 212, 3-9.
5. Committee 17 (1975) Environmental mutagenous hazards. Science. 1987, 4176, 503-514.
6. United Nations Scientific Committee on the Effects of Atomic Radiation (1977) Sources and Effects of Ionizing Radiation, 1977 Report to the General Assembly with Annexes, United Nations Publication, Sales No. E. 77.IX.I, New York.
7. United Nations Scientific Committee on the Effects of Atomic Radiation (1982) Sources and Biological Effects, 1982 Report to the General Assembly with Annexes, United Nations Publication, Sales No E.82.IX.06300P, New York.

Scientific Research Centre in Kiev.

CASE-CONTROL STUDY ON LUNG CANCER AND AIR POLLUTION IN KRAKOW

Wieslaw Jedrychowski
University Medical School
Krakow, Poland

The etiology of lung carcinoma involves the interplay of many environmental and host factors; the relative contribution of each is not completely clear. One essential environmental factor is the presence of respiratory tract carcinogens in inhaled air, derived from sources such as cigarette smoke, combustion of coal and oil, and industrial air pollutants.

Background: Preliminary analysis carried out earlier showed that Krakow, when compared with Poland as a whole, had a high lung cancer death rate for men and women, and that this high rate may be due to higher air pollution. However, several factors other than air pollution could account for the observed excess death rate, including better reporting of lung cancer deaths in Krakow, more cigarette smoking, and occupational hazards.

As there are very few individual-based epidemiological studies in relation to air pollution and lung cancer, a case-control study was conducted in Krakow to assess the combined effect of various factors. This paper presents a multivariate analysis of the results of this study.

Krakow covers approximately 230 km^2 and has a population of about 700,000 people. It is situated in the valley of the Vistula River, where long inversion phenomena occur as well as many foggy and misty days. The urban area, especially the center of the city, is characterized by little wind and frequent periods of stillness. The quickly growing metallurgical industry and the many oven-based heating units in houses in the old town are considered the main sources of air pollution in Krakow. In the city center, the average annual mean concentration of suspended particulate matter (SPM) is 150 $\mu g/m^3$ and of sulfur dioxide (SO_2) is above 100 $\mu g/m^3$, exceeding standard values levels of Poland and of Western countries.

Methods: A classification of exposure to community air pollution was based on measured levels of total suspended particles (TSP) and SO_2. The ambient air characteristics for the study were determined by a network of 15 sampling stations designed to measure TSP and SO_2 daily. Sampling was continued over 8 years, from 1973 through 1980.

The total TSP data were stratified into three levels: (a) less than 120 $\mu g/m^3$; (b) 120 to 150 $\mu g/m^3$; and (c) higher than 150 $\mu g/m^3$. SO_2 data were divided into four strata: (a) less than 56 $\mu g/m^3$; (b) 56 to 96 $\mu g/m^3$; (c) 97 to 104 $\mu g/m^3$; and (d) higher than 104 $\mu g/m^3$. The combined index of air pollution was developed subsequently on three levels and it was based on TSP and SO_2 concentrations: (a) low= TSP < 150 $\mu g/m^3$ and SO_2 < 104 $\mu g/m^3$; medium = TSP > 150 $\mu g/m^3$ or SO_2 > 104 $\mu g/m^3$; and (c) high = TSP > 150 $\mu g/m^3$ and SO_2 > 104 $\mu g/m^3$.

TABLE 1: AGE-ADJUSTED ODDS RATIO ESTIMATES BASED ON MULTIPLE LOGISTIC MODEL, MALES					
Predictor variables		Cases (N=901)	Controls (N=875)	OR	95% CI
Never smokers		49	221	1.00	-
Smokers:	1-20 pack-years	46	112	1.35	(.091-2.00)
	20-40 pack-years	271	211	4.18	(2.87-6.09)
	> 40 pack-years	482	262	6.35	(4.41-9.16)
	pack years missing	53	69	3.11	(1.92-5.05)
Age of beginning smoking* < 18 years		478	442	1.00	-
	Age > 18 years	374	212	1.26	(1.01-1.58)
Workers**	Non-manual	647	697	1.00	
	Manual	254	178	1.27	(1.01-1.62)
Occupational exposure 20 years: No		557	671	1.00	
	Yes	344	204	1.72	(1.37-2.17)
Air pollution	Low	650	631	1.00	-
	Medium	129	140	1.00	(0.75-1.33)
	High	122	104	1.47	(1.08-2.01)

* Only in smokers ** Including non-working men

The population studied were the 1,579 male and female residents of Krakow who died between 1980 and 1985 (6-year period) and whose deaths were attributed to lung cancer on their death certificates. For each lung cancer patient, an attempt was made to select a matched control subject from the Krakow death register as (a) the next person of the same gender, (b) who was within 5 years of age of the lung cancer patient, and (c) had no respiratory tract disease (ICD 140-150, 160-165, 480-519). A total of 1,491 control subjects were selected.

Through self-administered mailed questionnaires that were completed by the next of kin of patients and control subjects, data were collected concerning demographic parameters, highest educational level attained, places of residence, occupation, and smoking habits. Occupational data included a determination of whether longest-held job was manual or nonmanual, and assessment of type and duration of exposure (to coal, cement, asbestos, and metal dusts; metal vapors; and ionizing radiation).

TABLE 2: ODDS RATIO ESTIMATES BASED ON MULTIPLE LOGISTIC MODEL, FEMALES					
Predictor variables		Cases	Controls	OR	95% CI
Never smokers		76	167	1.00	-
Smokers	1-20 pack-years	20	7	3.26	(1.20-8.80)
	20-40 pack-years	46	9	5.18	(2.30-11.70)
	> 40 pack-years	48	13	5.46	(2.69-11.09)
	pack years missing	5	2	4.88	(0.91-26.13)
Workers*	Non-manual	166	183	1.00	-
	Manual	32	15	2.05	(0.96-4.38)
Air pollution	Low	97	117	1.00	-
	High	101	81	1.26	(0.78-2.05)

* Including non-working women

Results: For both males and females, increasing odds ratios (ORs) were found related to cigarette consumption expressed in pack-years (Tables 1 and 2).

OR estimates for suspected occupational exposure lasting longer than 20 years were significant only for men (OR=1.72, CI=1.39-2.17). Male manual workers had significantly higher rates (OR=1.27, CI=1.01-1.62).

By multiple regression, the estimated risk for air pollution was significant for men who lived in the highest polluted area (high TSP and high SO_2) (OR=1.47, CI=1.08-2.01). Data for women only allowed a two-level stratification: low=TSP<120 μg/m³ and SO_2 < 06 μg/m³; high=higher levels of TSP or SO_2. The OR for the higher level was 1.26, but this was not statistically significantly elevated.

We observed positive, but not significant, estimates for the interaction between (a) air pollution and smoking and (b) air pollution and occupational exposure. [Air pollution x smoking: beta = 0.29 ± 0.49 (males), beta = 0.37 ± 0.53 (female); air pollution x occupational exposure: beta 0.13 ± 0.40 (males), beta = 0.74 ± 0.86 (females); smoking x occupational exposure: beta = -0.26 ±0.37 (males), beta = 1.45 ± 1.20 (females)]. Although these results must be taken with caution, it is noteworthy that they are in the positive direction, which is a hint that a multiplicative, rather than an additive, relative risk model is appropriate.

Finally, we made estimates for the attributable risk (AR) under the prevalence conditions in Krakow. For these calculations, we estimated the relative risk of joint exposure categories. The AR in men was found to be 75 percent for smoking, while that for occupation was 15.5 percent and for air pollution, 5.38 percent. AR estimates for women were 37.7 percent for smoking, 7.4 percent for occupation, and 9.6 percent for air pollution.

Discussion: The final logistic model confirmed the effect of air pollution on lung cancer in males, but the data for women showed no trend with air pollution levels. With the same air pollution categorization as in males, an increased OR for the medium level and a decrease for the high level was found. These findings may be due to a selection bias among female controls. The lower risk for air pollution seen in men under 60 years of age suggests that older men have a higher risk of lung cancer related to common air pollutants, perhaps due to (a) longer residence at the last address (20 to 30 years, with increasing tendency for stability in higher polluted area), or (b) recall bias for very old subjects.

We think that our estimates of lung cancer risks due to air pollution may be underestimated in comparison to that of smoking. The effect of air pollution was not compared with a "null category," that is, with a region without any air pollution, while never-smokers served as a good reference group for smokers. The effect of smoking could appear stronger as a result of possible overreporting of smoking behavior for patients. The results may have been distorted because smoking habits were measured at the individual level while air pollution was estimated by broad areas of residence (and, therefore, did not necessarily accurately reflect total exposure to polluted air). A classification bias resulting in underestimation of true effects could have arisen when persons under study lived in less-polluted areas, but worked in more-polluted areas, although occupational dust exposure was controlled. The validity of air pollution estimates was limited by not obtaining complete residential histories -- only the last place of residence, although the population of Krakow is relatively stable.

HEALTH STATUS OF SCHOOLCHILDREN IN THE COPSA MICA AREA OF ROMANIA*

presented by
Eugen S. Gurzau
Institute of Public Health and Medical Research
Cluj-Napoca, Romania

Three different areas with nonferrous metallurgical industry (Copsa Mica, Baia Mare, and Zlatna) have received considerable attention in the mass media in Romania and in other countries.

Copsa Mica, with a population of about 8,000 persons in 1990, is mainly polluted by lead, cadmium, and other heavy metals and by irritants, especially sulfur dioxide. Another town, Medias (70,000 persons in 1990) lies at about 10 km from Copsa Mica. The pollution there is almost the same as it is in Copsa Mica.

The number of daily air samples in Copsa Mica varied between 84 and 113 per year between 1986 and 1990. The average of daily air lead concentrations exceeded the Maximal Allowable Concentration (MAC) of 0.7 $\mu g/m^3/24$ h in every year of this period. The concentrations were sometimes up to 50 times higher than the MAC. The percentage of samples that were greater than the MAC varied between 61 percent (in 1989) and 94 percent (in 1988). The level of air pollution with lead in Medias was nearly that found in Copsa Mica.

All 371 schoolchildren aged between 7 and 11 in Copsa Mica were examined for height, weight, and blood pressure, and for 44 of them, blood and urinary lead levels were determined and psychological tests were performed. Of the boys in Copsa Mica, 7 percent were underheight, 10 percent underweight, and 46 percent both underheight and underweight. Of girls aged 7 to 11 years, 11 percent were underheight, 10 percent underweight, and 47 percent both. The height and weight of schoolchildren living in the Copsa Mica area were statistically significantly lower than those in a control group ($p < 0.01$).

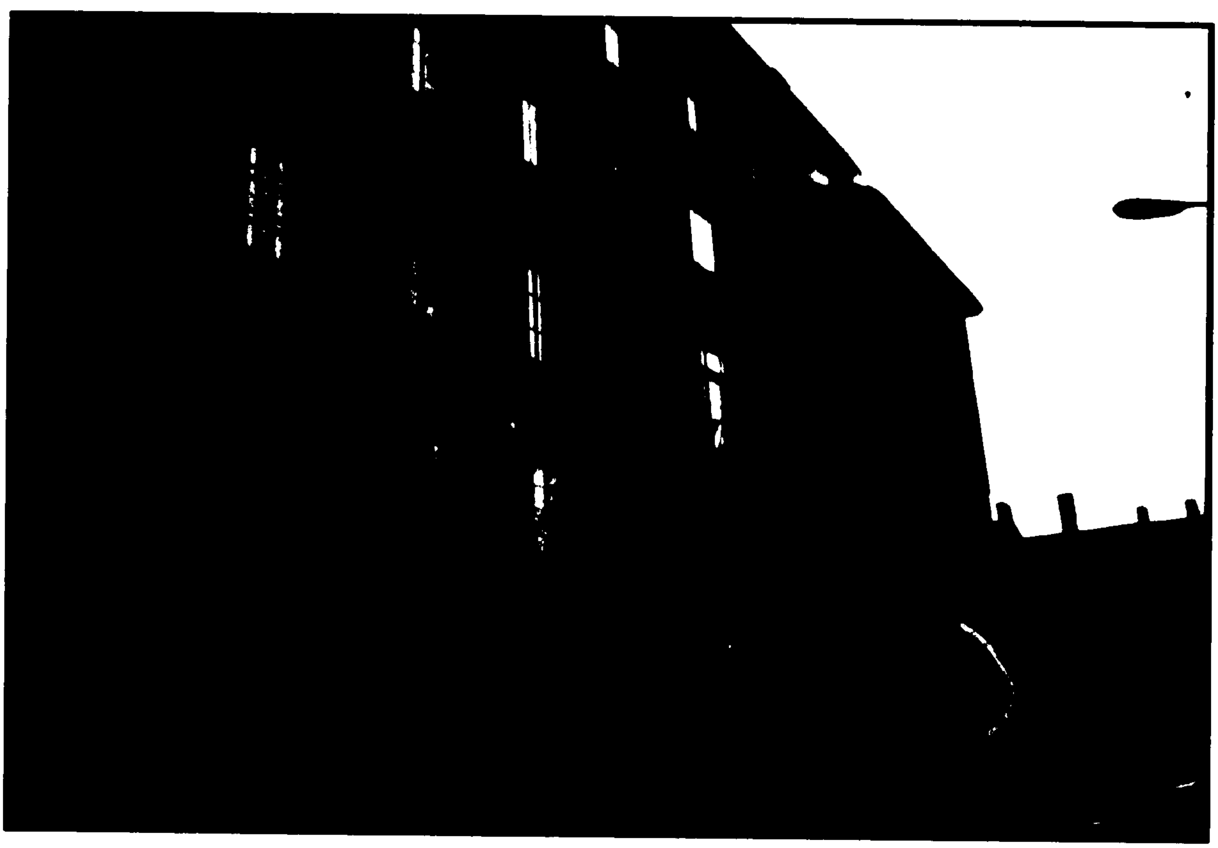
Blood pressure was measured in the 371 school children. Three values were determined for each subject during the daytime and the nearest value to the standard value for Romania was recorded. Both systolic and diastolic pressures were increased above normal in 30 percent of the boys and in 48 percent of the girls. The percentage of boys with blood pressure above the normal values was between 29 percent and 41 percent in children aged 9 to 11. In girls, blood pressure exceeded the normal values in 34 percent of those aged 7, and 60 percent of those aged 11. The differences between children living in the Copsa Mica area and children in control communities was statistically significant for each age, and also for all boys and all girls ($p < 0.001$).

---

* Authors of this paper are Eugen S. Gurzau, Marius Muresan, Ecaterina Bodor, Nicolae Radulescu, and Ana Maier.

Blood and urine samples were collected from 44 schoolchildren at the school located near the plant. The blood lead level was higher than 20 µg/dl, but less than 50 µg/dl in 43 (98 percent) of the 44 children. Urinary lead levels were lower than 50 µg/dl in each child studied.

We found the IQ's of schoolchildren in the Copsa Mica area to be statistically significantly lower than for schoolchildren in the control group ($p < 0.05$ for ages 7, 10, and 11, and $p<0.001$ for ages 8 and 9).



Main building of new school of public health in Krakow.

OCCURRENCE OF CANCER AND OTHER CHRONIC DISEASES IN AN ENVIRONMENTALLY POLLUTED AREA IN NAGYTETENY, HUNGARY, 1979-1989*

Presented by
Olga Kékesi
"Green Future" Environmental Association,
the Society of Hungarian General Practitioners,
and the National Institute of Hygiene
Budapest, Hungary

Nagytétény used to be a sleepy village decades ago, but it has been surrounded by an industrial ring of seven great chemical and mechanical factories now, as well as having a pig farm and a few small industrial workshops in its residential area. It is also crossed and bordered by main roads. The factories work with heavy metals and chemicals such as toluol, phenol, sulfate, sulfides, and benzpyrene.

The first scandal was in 1966 when the wastewater of the Metallochemia Factory flooded a great garden during a cloudburst; after a few years, horses died of lead intoxication, and the factory paid damages to the owners. The greatest heavy-metal pollution case around the Metallochemia Factory became known in 1977. By that time, the clerks protected their clothes from lead dust in the factory yard by using umbrellas. Then, hygienic authorities collected and destroyed all vegetables and fruit grown around the factory, and the owners of the orchards and the kitchen gardens received a small compensation. The Metallochemia Factory stopped operation, but only for 6 to 12 months.

A. Horváth and M. Grabner performed important studies on this situation.

Ms. Szabuka and her colleagues, in 1980, performed a study on children living here and compared data to those of a control area. They found that in this area the frequency of stillbirths was higher, the birthweight of boys was lower and their growth was slower, infant mortality was higher, and anemia and respiratory illnesses were significantly more frequent than in the control area. Total birth defects were not more frequent here than in the control area, but the three congenital pyloric stenosis cases that occurred here—among 737 pregnancies between 1968 and 1977—could represent a warning.

In 1990, studies showed that among the children the frequency of respiratory illnesses, especially asthmatic bronchitis and chronic bronchitis, is higher than those of the nation as a whole.

---

* Authors of this paper are O. Kékesi, E. Sárkány, P. Rudnai, Á. Prigli, Á Végári, and S. Firisz.

Blood lead level (BLL) and zinc protoporphyrin (ZPP) investigations were made. During voluntary screening, the BLL of 6 (1.4 percent) of 421 children and 9 (4.0 percent) of 223 adults, two women of 159 and seven men of 64, exceeded the 20 μg/dl limit value proposed by the World Health Organization.

The data showed significant differences between the values for children living within 1 km of the factory and those living further away (8.98 vs 6.83 μg/dl. Similar differences were found in adults (2).

Methods: We collected death certificates from the authorities, and death data from the general practitioners and the oncologic and pulmonary care stations of the 22nd district of Budapest. We obtained data for all residents of this district from the authorities and the care-stations. We sorted the data by the age, gender and residence of patients and of all residents. We compared cancer deaths to all deaths. After the direct or indirect standardization (by age, gender, and tumor-localization) by the national data, we compared local data to data for Hungary, for Budapest, and for the 22nd district of Budapest. We calculated expected values from national age-specific mortality rates.

Results and Discussion: Our studies between 1979 and 1984 and between 1980 and 1988 showed higher cancer mortality in the study area than for the nation, Budapest, and all of the 22nd district of Budapest. The overall mortality rate was higher in Nagytétény than in Hungary as a whole.

Standardized mortality ratios (SMRs) for women included breast cancer, 2.37; lung cancer, 1.57; colon cancer, 1.7; and SMRs for men included digestive system, 1.48; and urinary system, 1.42. The number of cancer deaths compared to all deaths were very high in certain small streets. It is very difficult to evaluate these small absolute numbers. The usual mathematical/statistical procedures can hardly be used, and they often do not say more than the simple comparison of the absolute numbers.

We found a few "tumorous family houses" in Nagytétény, in which married couples or other household occupants had cancer.

In Nagytétény, heavy metals and mixtures of other materials (such as toluol, phenol, sulfides, and nitrates) are present at many times the health limit in soil, groundwater, air, and plants.
We believe that the high frequency of cancers, and the above-mentioned children's illnesses, are not independent of each other and of the environment. We see causal connections between them.

More research on carcinogenic factors needs to be done in the environs of each cancer cluster.

HEALTH EFFECTS OF THE CHERNOBYL DISASTER: IMPLICATIONS FOR NUCLEAR PO.VER IN CENTRAL AND EASTERN EUROPE

Presented by:
Vladimir Lupandin
Institute of Sociology
Russian Academy of Sciences,
and the Center for Independent Ecological Programs
of the Social Ecological Union
Moscow, Russia

The attitude of the former Soviet government, official scientists, and the experts of the International Atomic Energy Agency (IAEA) is well known: "There are no health effects in Chernobyl. There is only radiophobia." With the disintegration of the Soviet Union and the process of democratization, it has become possible to carry out an independent international study of health effects of the Chernobyl disaster. The idea for such a study belongs to a well-known American scientist, Professor John Goffman of the University of California, Berkeley. At the meeting of the Center for People's Initiatives in San Francisco, in May 1991, he said: "It is important that the whole world should know the truth about Chernobyl. What happened here? It can affect the health of the population of the whole world. The independent examination by the IAEA was a farce. Radiophobia is not a science. There is an urgent need for an objective international examination with the participation of Russian, American, British, and other scientists. Five years have passed. It is not too late. We can help many people."

Taking part in our investigations were physicians, epidemiologists, biophysicists, specialists in medical radiology, geographers, psychologists, and ecologists. They all had much experience with ecological disasters. The American side was represented by Judith Johnsrud, co-director of the Coalition on the Prevention of Environment from Nuclear Power; Donald Boardham, ex-president of the Center of Radiation Studies; Jan Handke, Director of the Center of Radiation Studies; Francis Macy, Chief Consultant of the Center for People's Initiatives; and others. On the Russian side were Maria Cherkassova, Director of the Center for Independent Ecological Programs; Adolf Harash, Director of the Humanitarian Innovations Center, "Liza"; Irina Pelevina, head of a laboratory at the Institute of Chemical Physics of the Russian Academy of Sciences; others; and myself. The study was conducted in the Bruansk region of Russia; the Zhitomir region and Narodichi in Ukraine; and the Gomel region and Hoiniki of Belarus. The main findings of the study, conducted from February 1991 to April 1992, were published in the journals "Vrach"/"Physician"/#8 and #10, 1991, and "Priroda"/"Nature"/of the Russian Academy of Sciences, #8, 1992.

Description of the Chernobyl Disaster: On April 26, 1986, at 1:25 A.M., Moscow time, there was an explosion of the reactor in the fourth block of the Chernobyl nuclear power plant. There were 192 tons of uranium, spent fuel, fuel in cassettes, several tons of gaseous fission products, and 1,000 tons of graphite. According to a Byelorussian physicist's data, 60 percent of the fuel was released into the atmosphere over the next 10 days. At 1800°C, gaseous uranium products are emitted and dispersed in the atmosphere. Part "fell out" in the rain, leading to local contamination of vast regions from the Volga to Central Europe. A total of nearly 2.6 million curies were released. According to Soviet Government figures, 3 to 4 percent of radioactive products were released. According to data of the experts of the Military Medical Academy, 15.6 million people suffered from radiation (compared to 600,000 in Hiroshima), not counting 1 million "liquidators" (according to official figures, there were only 600,000).

The State of Health of "Liquidators": About 1 million liquidators, mainly young and middle-aged men, live in every country of the CIS. A careful examination of the state of health of 800 of them, carried out by the Military Medical Academy, showed them, in general, to be sick people: 90 percent needed treatment, 60 percent were in need of inpatient treatment, and 50 percent had sustained a radiation dose of over 25 rem. Their status has been described as "radiation reaction, overexposure to radiation." They were found to have various changes in blood, internal disorders, changes in the endocrine system, abnormalities of the central nervous system typical of radiation reaction, radiation trauma, and overexposure to radiation (up to 100 rem). The aggravation of all previous diseases was typical as well as a 15- to 20-year shift in age groups of those affected by a certain disease due to premature aging. The main finding of military doctors has been that there is a clear correlation between changes in the state of health and the dose and length of exposure to radiation. A dose of 50 rem can cause grave disorders. While studying the state of health of liquidators in the Chernobyl and other regions of Russia, we saw a picture similar to that given by the military doctors.

The Population: Both American and Russian researchers came to the same conclusion: the state of health of the population was much poorer than that prior to the accident. The complaints of the people are common everywhere: headaches, fatiguability, apathy, and a sharply diminished capacity for work. The people cannot work long hours. The doctors everywhere observe diseases affecting younger people and a 15-to-20-year aging of people. The people's sight is failing; the number of people with cataracts and blood disorders is growing. The observed disorders are identical to those found by the military doctors in liquidators, but they are somewhat less pronounced. American specialists on noncancerous health effects described them as "small-dose effects." They had observed similar symptoms in testers and x-ray specialists.

Children: There are common complaints everywhere: fatigue; diminished work capability; defective memory; failing eyesight; headaches; and pain in the legs, joints, bones, and abdomen. Ninety percent of children have enlarged lymph nodes, 30 percent suffer from gastric and intestinal disorders, and 15 percent have changes in blood. Our general conclusion is that these health disorders in children are caused by radiation and are not related to radiophobia. This conclusion is confirmed by the findings of other experts. In Belarus, thyroid cancer has been diagnosed in 102 children. In the Bryansk region, specialists from the Institute of Pediatrics and Child Surgery find early cases of chronic radiation sickness, according to their estimates, in 50 percent of the children receiving a dose of over 200 rad in 5 years and in 50 percent of the children remaining in the area where the level of contamination by cesium-137 is over 40 curies per km^2. This very serious statement needs to be confirmed, but it fully agrees with our findings.

Malignant Tumors: We observed an increase in cases of malignant tumors in all the regions surveyed. There is a marked increase in cases of leukemia, laryngeal cancer, and occurrence of thyroid cancer. A strict epidemiological study is necessary, but there seems to be an increased occurrence of malignant tumors.

Acute Radiation Sickness: A survey of the case records at the military hospital in the Hoiniki region showed that the number of patients with acute radiation sickness of the first and second degree (100 to 200 rad) were several thousand. All of them had remained very near to the reactor for more than 10 days, where the level of gamma-radiation was 450 mR/h. These case records are of great scientific value and should be studied by international experts. We were able to obtain information for about 174 people in the village of Ulasy, situated not far from the reactor: 20 people there died in 5 years, mainly due to cancer.

Summing up, we have a complex picture of radiation injury of the residents of the regions that suffered from the Chernobyl disaster. We have seen radiation reactions or radiation trauma (from 5 to 100 rem), probable chronic radiation sickness (200 rad in 5 years), and after-effects of acute radiation sickness (100 to 200 rad). The mechanism of small-dose effects is not clear. There seemed to be increased radiosensitivity in the people exposed to radiation in the first weeks after the disaster and chemical hypersensitivity. A certain role has also been played by stress, which the American experts called radiostress. Yet, there is no reason for speaking of radiophobia.

I will now address the political and philosophical problems of the Chernobyl disaster. Whatever differences we may have on certain questions, one thing is clear: the scale of the Chernobyl disaster was greatly underestimated. Radiation injury of hundreds of thousands of people, including children, has been kept secret for 6 years. Cases of chronic radiation sickness were found by scientists 200 kilometers (about 125 miles) from the reactor. Unfortunately, the most gloomy predictions of John Goffman and Andrei Sacharov have been verified.

The prognosis of the military radiologists who worked in the disaster area is coming true. They demanded a total evacuation of people from the 100-km zone and predicted the emergence of chronic radiation sickness. We can draw a conclusion: there is no doubt that the perilous effects of the Chernobyl disaster have been played down. The risks of an accident at a nuclear power plant are underestimated.

An explosion of a reactor at a nuclear power plant, built by the former Soviet Union in Eastern Europe or in the CIS countries neighboring Central Europe, can lead to changes in the political map of Europe. I would like to draw attention to the dangerous state of affairs in modern science. The Chernobyl disaster demonstrated that science failed to evaluate the situation there and to protect the life and the health of many hundreds of thousands of people. We cannot put the blame only on former leaders and IAEA experts who were at one with them. The problem is much more serious, the present situation is much more dangerous than it may seem to those who put numerous calamities down to misinformation, secrecy, and lies. Modern science failed to regard the Chernobyl situation as a reality, outside of conceptions. The Chernobyl catastrophe was seen in the light of our perception of Hiroshima, on the basis of the data obtained in clinics and laboratories. "We have not seen it, therefore no such thing could have been." This is an issue of world outlook. Modern science sees the world and the Chernobyl situation as a stable, strictly determinated system, described by simple equations of the "dose-effect" kind. Even the scientists whose honesty is beyond doubt do not consider children to be suffering from radiation and are convinced that the children of the region do not suffer from common health disorders due to lack of meat, fresh fruit, and vegetables. We do not wish to regard it as if they were trying to deceive anyone. It is the way the world is seen by the scientists who over 300 years cultivated the apology of the ideas of determinism based on the Newtonian system.

We believe that this is very dangerous. When differences arise from departmental interests, when there are lies, deceptions, deliberate distortion of facts, and past history, as was the case in the former USSR, this indeed was to be regretted. But they could be overcome, you could hope for a break-up of the totalitarian system, as happened in the USSR. But it is much more dangerous when reality is denied existence because it does not accord with our perceptions, and contradicts the present dominant scientific conceptions. As it turns out, the problem is settled in favor of scientific conceptions: if reality is not in accord with them, goes beyond generally recognized bounds, so much the worse. It has taken over 300 years to form the conception of stability of the world in the spirit of oversimplified interpretation of the universe according to the Newton-Laplace theory.

It will take the lifetime of a whole generation to change that paradigm. New ecological disasters can occur over this period and the ecological crisis can become irreversible. This is another reason why independent international programs investigating different ecological disasters should be promoted and supported.

What are the implications of the investigation of health effects of the Chernobyl disaster for nuclear power in Central and Eastern Europe? I think that the development of nuclear power in that part of Europe should be suspended until the problem of health effects of the Chernobyl disaster is settled. The myth about the satisfactory state of health of the population in the Chernobyl region is breaking up. The process cannot be reversed unless the totalitarian regime is reestablished. That is why I think that the IAEA policy concerning the health effects of the Chernobyl disaster should be changed. Specialized medical aid is necessary for the population of that region of Eastern Europe.

A UKRAINIAN PERSPECTIVE ON THE CHERNOBYL DISASTER

Leonard Dobrovolsky
Institute for Occupational Health
Kiev, Ukraine

The Chernobyl disaster remains of great concern not only to Ukrainian scientists, but also to those of other countries. Yet, even now, six years after the accident, there are still few data on health effects.

Many specialized institutes in Ukraine, such as the Ukrainian Scientific Center of Radiation Medicine, are studying the problem, as are some institutes that are not specialized in radiation, such as the Institute of Occupational Health.

Much of northern and western Ukraine has been contaminated by radionuclides, but contamination of the soil is not uniform in these areas. You can see in the same village, one part that is more or less normal and another that is heavily contaminated.

The Chernobyl atomic power station, unfortunately, is situated on a river that is a tributary of the River Dnieper, which provides water to 30 million people in our country. Although neither river is now contaminated with radionuclides, this is potentially a very dangerous situation.

For a period after 1986, people in northern Ukraine had higher levels of external radiation exposure, but these have now decreased again.

In contaminated regions, children and pregnant women have been shown to have higher rates of iron deficiency anemia than elsewhere in the country.

Since early 1990, there has been a trend of increasing numbers of thyroid cancer cases among children in the contaminated regions. However, we cannot draw strong conclusions from this now. These studies are continuing and there will be a study of reproductive function in the contaminated region. The Chernobyl problem is still serious. We need assistance in dealing with and studying its consequences.

PART THREE: METHODS AND APPLICATIONS

SECTION EIGHT: STUDIES OF SOCIAL FACTORS AND HEALTH

Top row: Zsuzsanna Füzesi, Paul A. Landsbergis, and Jan Kopczynski.
Bottom row: Karel Blaha and Małgorzata Pánkowska.

WORKERS' PERCEPTION OF COMPANY DOCTORS: A SOCIOLOGICAL INVESTIGATION*

presented by
Zsuzsanna Füzesi
Medical University of Pécs
Pécs, Hungary

Occupational health constitutes an important part of the Hungarian health system. In 1989, occupational health services, operating at approximately 2,900 firms, covered 2.0 to 2.5 million employees. The total number of employees in the country was 4.5 million. This means that the primary care of about half of Hungarian workers was, in 1989, provided at work. Among company doctors, 940 were full-time, 1,426 were part-time, and 500 worked both in companies and in community settings as general practitioners. About 8 percent of Hungary's medical practitioners were involved in delivering occupational health services.

This system has had a number of problems. I will discuss the attitude of the users of occupational health services, since users' attitudes and expectations both reflect and affect the functioning of the whole system. But first, I will summarize characteristic features of the existing system: contradictions of paternalism; complicated, bureaucratic centralism; and a dual dysfunctional value system.

The system could be called paternalistic because, on the one hand, the State is the owner of the firms and thereby is responsible for the welfare of the workers and for workplace conditions that cause health hazards. The State, under Hungarian socialism, had a monopoly on the protection of employees' rights to health, and it provided services to prevent occupational injury and illness.

The system is bureaucratic because of the many directives, administrative rights, and complicated connections to other fields of health services, which made the system unreasonably confused and riddled with conflicts due to overlap of interests.

The dysfunctional value system was the result of dual financial dependence. Hungarian company physicians were officially independent from the firms; they were said to be paid by the national health care system. In practice, however, everything was quite different. Due to the poverty of the health care system, the firms supplied the necessary capital equipment and, in many cases, they also provided supplies. Richer companies (not necessarily more efficient ones, but those with a higher subsidy from the national budget) could spend more on operating their occupational health services.

* Authors of this paper are Zsuzsanna Füzesi, Charles Levenstein, and Eve Spangler.

doctor" performing physical examinations, writing prescriptions, performing sick leave evaluations, and giving first aid; (3) professional competence; (4) the company physician's special knowledge in occupational health; and (5) the company physician as one who protects the employees' rights to health.

The first three items refer to the general doctor-patient relationship; the latter two issues, to occupational medicine. The most favorable attitudes concerned company physicians' special activities in connection with occupational health and health promotion. Less favorable attitudes were expressed toward plant physicians' performance as general practitioners. The most important negative attitude was toward company physicians' professional competence. Whether the company physician has the power to put workers on sick leave also results in significant difference in satisfaction. Company physicians who do have the right to put patients on sick leave (as do doctors in primary care) are more highly regarded than the ones who have no such authority.

We believe that a significant component of this pattern is the fact that free choice of physicians has not existed in Hungarian primary health care system. People had appointed district and plant physicians. Moreover, the employees whose plant physician had the authority to put people on sick leave could not go to their district physician instead (except for emergency and chronic

Street scene in Krakow.

care). Employees whose plant physicians had no authority to put people on sick leave did not have much reason to see them and were discouraged from doing so, because such visits served only to increase physician visits. In the case of company physicians who could put people on sick leave, curing activities were prominent; where company physicians had no such authority, other activities (for example, screening or writing prescriptions) accounted for a higher proportion of the workload.

Nevertheless, this occupational health care system—even in its most problematic form—was relatively advantageous for certain groups of employees. This explains the difference between satisfaction and attitudes of different occupational groups. Two occupational groups particularly could take advantage of the opportunity provided by the occupational health services. White collar workers in our sample, mainly women with a general education certificate working in administrative jobs, used the company health system more than others. Miners also used the occupational health care system more, though for different reasons. Due to political ideology, miners were a worker group of great importance. Operating the occupational health care systems at the mines according to the highest principles was politically important. So these sites were better equipped and more elaborate than those at other work places. Also, more attention was paid to screening and care of miners.

SICK-LEAVE SYSTEM

Company doctors were entitled to give sick leave only if they could ensure the following necessary conditions:

The plant had a full-time company doctor's position.
The doctor was responsible for one plant only.
The doctor was properly qualified.
The company doctor had two or more assistants.
The consulting room was established and equipped according to regulations.
There was an optimal number of plant workers on the basis of the given norms.

These criteria were ordained by the local health administration. If a doctor worked part-time or was responsible for more than one plant, he or she was not entitled to grant sick leave.

If a company doctor of a given plant obtained the right of giving sick leave, then all the workers living in the given area who were out-patients had to go to the company doctor, no matter how far their homes were from the company doctor's consulting room. Doctors entitled to give sick leave to the adults capable of working in Hungary include district doctors (general practitioners), district-company doctors, company doctors (only those who have this authority), and district pediatricians (sick leaves for child care welfare).

Except for the company doctors, all doctors working in basic health care are entitled to give sick leave. In addition, some specialists have the authority to give sick leave. Every doctor tries to put patients on sick leave at somebody else's cost; for example, the specialist sends the patient back to the company doctor so that the latter can put and keep him or her on sick leave, although this is not in the company doctor's own interest, who does not want to worsen statistics by putting many patients on sick leave.

Sick leave was a political and not a health issue in past decades. The decision of the Council of Ministers in 1976 supports this assertion. This decision was based upon necessary action to strengthen the sick leave system and sick leave discipline. The reason for this decision: "In the past few years, the high number of patients on sick leave is not in relation to the health state of the population. The reason can be from the negligence of the judgment of the working capability on the one hand and on the other hand, it can be the abuse of the applications for working compensation." This decision ordains that sick leave shorter than 3 days has to be paid by the plants (by debiting their untaxed profits), not by social security.

After we completed our analysis, the Hungarian parliament changed the sick leave regulation. According to the previous regulation, social security paid. According to new regulations, when the employee is put on sick leave, the employer pays the expenses of the first 10 working days, and, only after this, social security finances the expenses. Although there is not any analyzed experience concerning the consequences of the new regulation, experts agree on some anticipated consequences:

1. When a company doctor who is entitled to give sick leave puts the employee on sick leave, it causes large expenses for the employer, which will be the source of conflicts between the employer and the company doctor.

2. A parent has the right to be given sick leave when his or her child under 14 years of age is ill, and the expenses of such sick leave are paid by social security. Ill employees may try to falsely put themselves on child-care sick leave in order to avoid conflict with their employers.

3. Employers are eager to "get rid of" their employees who are ill too often.

4. Certain industrial branches and plants (because jobs and working conditions are hazardous to health) may be brought into disadvantageous positions. These may include mines, construction companies, and chemical plants.

Although no decision has been made, reform of the health care system is on the national agenda in Hungary. A likely direction for this reform is towards the family doctor system. In our opinion, in spite of the dysfunctional operation of the occupational health care system, it should not be abandoned. Reorganization is needed. In this reorganization, the original principles of the occupational health care system are worth reaffirming.

WORK ORGANIZATION, STRESS, AND HEALTH IN THE UNITED STATES

Paul A. Landsbergis
Hypertension Center
Cornell University Medical College
New York, New York, USA

A large body of evidence has been published over the past decade linking job stress with cardiovascular disease. There have also been many new programs and efforts to reduce the illness risks of stress. I will summarize the evidence on stress and cardiovascular disease (CVD) and discuss stress reduction efforts.

While many stressors have been studied—overtime, piece-rate, shift work, job insecurity, social isolation, repetitive work, assembly-line work, electronic monitoring, sexual harassment, and racial discrimination—theoretical models attempting to incorporate these specific stressors have not been well developed. Therefore, we are indebted to Robert Karasek and Tores Theorell, whose ongoing work has elaborated the "job strain" model and provided scientific evidence for the connection between stress and illness. I strongly recommend their excellent book *Healthy Work*. Karasek's model suggests that the greatest risk to physical and mental health from stress occurs to those workers facing high psychological workload demands and low control in meeting those demands (a situation called "job strain"). Control is measured by both the skill level of the job and the decision-making authority available to the worker. With the help of work by Jeff Johnson and Tores Theorell, a third factor has been added to the model: social support from co-workers and supervisors, which is protective against illness.

Why focus on stress and this theory when we have so many other problems? First, in *Healthy Work*, estimates of population attributable risk in various studies for CVD due to job strain range from 7 to 33 percent. In the United States, CVD accounts for nearly half of all deaths. Of course, there are additional costs from stress-related psychological disorders, gastrointestinal illnesses, absenteeism, and other problems. Second, by documenting this hazard, we show how the organization of work—an organization based on the assembly-line, on Frederic Taylor, on reducing workers' skills and influence—can produce not only illness, but also passivity and lack of motivation. Karasek's theory has two predictions—increasing risk of heart disease in high-demand-low control situations and increasing activity and motivation to learn in high demand-*high* control situations. When workers' influence or control is taken away from them, under communism or under market economies, the psychological effects (hopelessness and lowered productivity) can be as profound as the physical effects of stress.

Let us consider some of the evidence for the "job strain" theory. Over the past 11 years, 14 studies on "job strain" and CVD have been published. Of these, 12 have shown clear links between "job strain" and CVD. More importantly, of the 8 cohort studies in this group, 7 showed strong positive associations. For example, in a national United States sample, workers in jobs with high average "job strain" scores had a significantly higher prevalence of heart attacks, within each age group, than other workers.

Of 20 studies of risk factors for heart disease, also published during this period, patterns were as follows. Two of the 4 studies found a link between "job strain" and smoking. Studies of clinic blood pressure found no association. However, of the 8 studies where an ambulatory (portable) blood pressure monitor was worn by workers during a work day in order to get more reliable readings of blood pressure, 6 studies showed strong positive associations, while the other 2 provided mixed results.

In order to determine whether blood pressure elevation is a significant biological mechanism linking "job strain" and CVD, we began an ongoing prospective study of "job strain" and blood pressure (BP) in 1986, under the direction of Peter Schnall at Cornell Medical Center in New York. Participants wore an ambulatory BP monitor for 24 hours on a work day. During the first round of the study, we found that workers who reported "job strain" (about 21 percent of the sample) had systolic ambulatory BP at work about 7 mm higher than those without "job strain", controlling for age, race, alcohol, body mass index, sodium excretion, Type A behavior, education, smoking, job physical exertion, and work site. The effect on diastolic BP was about 3 mm and also significant. Also, the higher BP among stressed workers occurred not just at work but *also at home and during sleep.*

For workers without "high-strain" jobs (that is, without "job strain"), systolic BP went up only slightly with age. However, for workers in "high-strain" jobs, BP rose sharply with age. A similar pattern was observed for diastolic BP. Finally, we have preliminary results for 197 of these men, who have now been examined twice over a 3-year period. Workers reporting "high-strain" jobs at both Time 1 and Time 2 had Time-2 systolic BP nearly 6 mm higher than predicted by Time-1 BP, compared to the group without "job strain" at either time. Leaving a "high-strain" job also appears to be beneficial for blood pressure. Similar patterns were seen for diastolic BP.

Our future efforts include these strategies, which may be useful to others planning stress research: We are testing these effects over a nine-year period, and examining associations for the 90 women that are now in the study. Levels of workers' influence, not just in their specific jobs, but also at the group, department, or company level, need to be examined. We are trying to measure "job strain" more objectively by averaging people's ratings of "job strain" within a job title, and by looking at other features of the work environment that may be correlated with "job strain". In addition, since only current levels of "job strain" have been measured, detailed work histories are now being obtained from participants to see how long their exposure to "job strain" may have existed. Several new tests have been added: one for urinary catecholamines and cortisol to better assess the biological mechanisms involved in BP elevation; and an ultrasound device to measure the extent of atherosclerosis in the carotid artery. Finally, we will be analyzing social support from supervisors and co-workers; other job characteristics such as physical exertion, job security, and physical hazards; and non-work stresses such as marital dissatisfaction, number of children, and low income.

One of the "objective" sources of stress that has become a major problem in the United States today is electronic monitoring, or surveillance. Over 10 million workers in the United States are subjected to monitoring through employers secretly listening in on phone calls, counting keystrokes on computers, or using video cameras. Studies show that many companies use monitoring to punish or humiliate—not to reward or fairly evaluate—workers, and end up emphasizing quantity or speed of work, not quality.

A study in 1990 by the Communications Workers of America (CWA) at a large telephone company showed that monitored workers had higher rates, not just of psychological stress, but also of "stiff or sore wrists," "loss of feeling fingers or wrists," and other symptoms of repetitive strain injuries (RSIs). We need to better understand how this interaction between psychological stress and physical stress and injury occurs: Is it because monitored workers take fewer breaks, work longer hours, or type faster? Is it because they are fearful about complaining about poor equipment, unfair supervisors, or high-pressure work? Is it because of increased muscle tension or other physiological changes?

Whatever the explanation, such work pressures seem to have played a role in an epidemic of RSIs in the United States in the past decade. High-risk jobs for RSIs include meat packing and poultry work, letter-sorting by machine, supermarket check-out work, garment work, and work as telephone or computer operators, typists, newspaper reporters, and hospital workers. Part of this increase is due to better reporting. However, some may well be due to the increasing speed of work, de-skilling of jobs into simpler more repetitive tasks, and fear of losing one's job. Preventing these injuries is now a high priority for unions in the United States.

Stained glass window honoring famous Polish scientists.

What are the strategies for reducing the risk of illness due to job stress? I have categorized these into a corporate or individual health approach, and a union or public health approach.

Individual stress management programs, which include muscle relaxation, meditation, or counseling, are widespread in the United States Three out of five large companies have such programs. But there has been little research on their long-term effectiveness, and they treat symptoms not sources, of stress and tend to blame the victim. For example, for Congressional hearings in 1984 on problems faced by air traffic controllers, Dr. Karasek reviewed a videotape on stress produced by the Federal Aviation Administration, the employer, and shown to all controllers. On tape it was stated that stress depends on demands and the person; control was not mentioned. It said that to cope with stress you have to question that "Real-world events are causes of stress," rather, "Interpretations of events are the cause." It stated that "Expectations of fair treatment at work are irrational in the modern setting" and that "Workers' misformed expectations of fairness cause the problem." It is suggested that, to relax, workers "visualize streams." (I do not know if they suggested visualizing an uncrowded airspace above an airport.)

Health promotion programs are similar efforts to encourage people to exercise, have a better diet, and quit smoking. However, in United States programs, there have rarely been attempts to identify environmental causes of illness or stress. Participants are more likely to be non-smokers, and white-collar workers—that is, those in better health. Programs have usually not been targeted to meet the needs and schedules of blue-collar workers. Where unions are involved in company employee assistance programs (EAPs) or where unions run their own EAPs, and/or workers' confidentiality can be protected, these programs provide a valuable service.

Quality of work life (QWL) programs usually focused on product quality and productivity, not health or job redesign. And many failures exist. For example, in a large New York City area medical center, cost savings from the QWL program led to layoffs, distrust, and collapse of the program. In other situations, employees have been suspicious that QWL programs will result in increased workload, layoffs, or attempts to avoid unions. For example, the United States Postal Service has traditionally had an authoritarian management system. Grievances take an average of 2 years to settle and workers have no right to strike. In the 1980s, management began an employee involvement program. The union filed charges that this program was being used to circumvent the traditional collective bargaining process. One month ago, our government's labor relations board ordered the Postal Service to stop such interference with regular contract negotiations.

The union-public health approach looks at stress as another workplace hazard. But job stressors are not covered by the Occupational Safety and Health Administration (OSHA) in the United States, so unions and public health professionals have relied on other strategies, as outlined below:

Collective bargaining: There is a large shortage of nurses in the United States Many nurses have left the field due to feelings of "burnout" and denied professionalism. To fight this, some unions have bargained for more skill development and influence: clinical career ladders for nurses in various specialties, training for nurse practitioner positions, and joint doctor-nurse committees on patient care. Clerical workers have organized and won strikes in the last decade, with some of the major issues related to stress: job security, chances for advancement, fair pay, child care, flexible hours, and having more influence. Computer workers have bargained for better ergonomic conditions, work organization, work variety, control over schedule, and regular breaks.

Workers' compensation: Claims of psychological injury from chronic job stress greatly increased in the 1980s because of liberalized laws in some states. This area will continue to be a major battleground between workers and employers.

Labor-management committees: A successful committee on job stress has been operating for 5 years now at an automobile parts factory in Michigan. (It is described in detail in a new book on occupational stress now being published by the International Labor Organization.)

Local union committees and other local action: A growing trend in the United States is the formation of local union committees on job stress. For example, members of the CWA who work for the State of New Jersey child welfare agency set up a stress committee several years ago. They discussed personal ways of coping with stress. But the biggest stressor they faced was the mainframe computer system. They have a huge amount of paperwork, and depend on data from the computer to do their work. But they had little access to the central office computer in another city. Coding was complicated and feedback reports unclear. Many workers did repetitive data-entry work. So the union committee helped redesign this work. They hired a consultant to talk to workers about what they needed from new computer software. They provided people with personal computers and allowed them to get information immediately from the central office computer. People were thoroughly trained on using the new software. Another example is an Oil, Chemical and Atomic Workers (OCAW) union local in New Jersey that has a work and family committee. Union members meet and negotiate with management during work hours, to improve company policies that have a stressful effect on workers' personal lives. Important issues have included mandatory overtime and no-advance-notice of overtime, paid personal leave and parental leave, access to a telephone during work time, and other scheduling-related policies.

A United Auto Workers local has a job stress program for its members in the New York City area. It holds lunchtime educational workshops and it has ongoing stress committees at nine work places. The committees (a) discuss personal ways of dealing with stress (problems with child care, money, addictions, exercise, and relaxation); (b) document job stressors (in one office it dealt with vacation benefits, smoking policy, and computer work); (c) file group grievances; and (d) develop contract language.

These union programs are examples of the exercise of "collective control." Workers learn that their feelings of stress are not their own fault but are shared by others, and therefore avoid the additional helplessness and powerlessness that come from self-blame for feelings of stress. However, such programs are threatened by cuts in government funding, rising health care costs, the current state of the United States economy, relatively high unemployment, and the United States federal budget deficit. Also, such programs are limited to the 16 percent of United States workers who are members of unions.

Job redesign: Redesigning jobs in order to make work more healthy is not a common strategy in the United States However, another area where unions have pushed for redesign is electronic monitoring. For example, CWA members in Arizona, together with telephone company management, eliminated measurements on and secret observation of individuals. Average work time was measured only for the whole group. Service observation was done by a small group of peers sitting beside the person being monitored, listening to a few calls and then discussing the results with the employee. The employees felt better, average work time was better than under the old system, and there were fewer customer complaints. Monitoring is now a major bargaining issue for 380,000 telephone company employees in the United States, and monitoring has been banned in some recent contracts.

Legislation and political action: Various laws are now being proposed in the United States to increase workers' rights and reduce job stresses: (1) laws that will permit greater union organizing and ban permanent replacements for strikers; (2) laws to reform OSHA, limit electronic monitoring, and regulate computer and ergonomic hazards; and (3) laws on family issues: providing parental and personal leave, day care, and eldercare. In addition, some unions in the United States are discussing the creation of a labor party.

In conclusion, despite the persistent need for more research, evidence exists that "job strain" is a real risk factor for illness, especially cardiovascular disease. In addition, there are various practical strategies, which are not necessarily costly, to reduce this stress and the risk of resultant disease.

When considering new government policies, remember that in the United States the OSHA law mainly gave government *inspectors* power—power that could be easily weakened by a government not interested in enforcing safety or in creating new regulations such as those on stress or ergonomics. In Sweden and Norway, the 1977 work environment laws gave *workers*—safety stewards and local safety committee members—more power and provided real guidelines for healthy work.

In an unregulated market economy with weak unions, corporate strategies for stress reduction will prevail—strategies that treat symptoms, not causes, and blame individuals for stress and illness. In a regulated market economy with strong unions, workers have more power to bargain for better working conditions and to achieve more security, skills, influence, respect, and dignity on the job.

SOCIAL CORRELATES OF THE HEALTH STATUS OF THE POLISH POPULATION

Jan Kopczynski
Institute of Social Medicine
Warsaw Medical School
Warsaw, Poland

Population-based information regarding social correlates of health status in Poland is inadequate. This report is mainly based on the studies of the author and his associates, and may, at best, be regarded as a random sample of data which an average epidemiologist could have collected had he or she happened to dip into the pool of community health data.

Urban-rural differences in health status: These comparisons are available annually for the total community, but their validity as social indicators is unclear. Unlike in the West, the life expectancy of urban dwellers in Poland is shorter than that of rural inhabitants, especially at older ages. This difference and the falling urban-rural difference in infant mortality suggest environmental involvement: stronger boosters for chronic diseases in the cities, but more social deprivation affecting infants in the rural areas.

Social contrasts in general morbidity: These data are mainly from *ad hoc* surveys. They usually show a strong association between ill health and social underprivilege, but much of it could be due to a cohort effect. Higher morbidity associated with less education is present mainly among older persons and for various occupations and various periods of follow-up.

Social differences in the frequency of various conditions: Getting into details reveals more involved patterns, such as decreasing prevalence of being overweight with rising level of education in females, but the opposite trend among male Krakow dwellers in late 1960s. A similar gender pattern in the prevalence of hypertension was encountered among the adult population of Ochota quarter of Warsaw in late 1970s, despite stratification by age and obesity. Probing for the causes of the stronger inverse social status-hypertension correlation among females than males suggested the role of occupational factor(s), concealed in variables such as "repetitive work" in contracting hypertension (Table 1). But other variables, like "fear of work loss" or "lack of spare time," seem protective, especially for males. The latter association may stem from a possible "anti-hypertensive" effect of a proactive approach to life problems, revealed by other statistical models and the follow-up phase of the same investigation. Other factors may be operative, such as protracted stress (represented, for example, by rejection of inadequate housing conditions, Table 1) and suppressed anger.

The role of social factors in prognosis of chronic disease: Social factors seem to contribute not only to the presence of common chronic diseases in the community, but also to the outcome of some of the diseases. The data from a 17-year follow-up study of a large cohort of Warsaw diabetic patients suggest a survival advantage conferred by a higher level of education, regardless of the cause of the ensuing mortality, particularly among younger individuals. The effect is

TABLE 1: RISK OF INCIDENT UNKNOWN ARTERIAL HYPERTENSION IN RELATION TO AGE, OBESITY, AND SELECTED SOCIAL OCCUPATIONAL FACTORS, WARSAW, POLAND, 1979-1989

Variable		Odds Ratio	95 percent Confidence Limits
Age (increase per decade):	Men	1.0	0.8-1.1
	Women	1.3	1.1-1.5
Obesity		1.7	1.2–2.5
Blue collar occupation		1.5	1.1–2.2
Lack of spare time		0.7	0.5–1.0
Dissatisfaction with housing conditions		1.5	1.1–2.1
Repetitive work	Men	0.9	0.5-1.5
	Women	2.1	1.3-3.3
Fear of work loss	Men	0.6	0.3-0.9
	Women	1.2	0.7–2.1

modest compared with conventional risk factors for death from complications of diabetes mellitus, but the social trend in survival ratios is present in most age and gender groups.

Discussion: Interpretation of these data is not easy because the proxy variables used for presenting the interaction of health and social factors are not immediately convertible into ignorance, poverty, social deprivation, stress, occupational hazards, need to earn money, or paucity of adequate health care. In view of the crucial distinction between intrinsically social and psychological sources of health stratification, it seems that the former would better fit the prevalence data since social burden of disease could hardly be attributed to choice, preference, or free will. The same is probably true for the impact of gender on the occurrence of hypertension, although incidence is also affected by behavioral factors such as stamina, anger, or cigarette smoking. On the other hand, a doctor's or patient's behavior can influence survival of a diabetic patient over a long period.

In addition to the possible present-day causes of social stratification of health events, the data presented may reveal some cohort effects. The data at times suggest that social contrasts in health seem to be larger among older people, which may be valid in view of the burden endured by the population in this part of Europe in the past decades. One wonders whether, after the period of compulsory unification of economic status of the total population, the growth of opportunity will diversify health outcomes.

THE OCCUPATIONAL HYGIENE SERVICE IN CZECHOSLOVAKIA

Karel Blaha
National Institute of Public Health
Prague, Czech Republic

In Czechoslovakia, the Occupational Hygiene Service plays an important part in occupational health and occupational medicine. The service is under the supervision of the National Institute of Public Health. Unfortunately, the public does not trust the Service because they have kept data on all exposures secret.

The ten regional hygiene stations are involved with occupational health. Each regional hygiene station employs 300 to 400 people, but has nothing to do with the regular hygiene service. Each district hygiene station supervised occupational medicine in its district, inspecting work places, checking levels of exposure, and taking preventive measures.

Each regional hygiene station has a department of hygiene, usually called environmental or communal hygiene. Its work includes epidemiology, microbiology, and radiation protection. District departments of occupational hygiene inspect large factories and performs some laboratory research. They vary according to the type of industry and types of hazards in a given district.

I work in the Center of Industrial Hygiene and Industrial Diseases. There are three other large centers at our institute: one on environmental hygiene, one on radiation and radiation protection, and one on epidemiology and microbiology. There are special laboratories at our institute and other institutes. In addition to our center on occupational diseases, our institute has laboratories for physical hazards, xenobiotics, neurophysiology, neuropsychology, pulmonary physiology, toxicologic analysis, and biological monitoring. The last of these has developed biological exposure tests for organic solvents and styrene. Important parts of our center are our national reference laboratories.

There is a proposed new law dealing with public health, including occupational health. Most likely, the district hygiene station will be the most powerful body because it will have a good connection with the district authority. Possibly, the regional hygiene stations will be closed.

At present, most policies, regulations, and standards are determined by the Chief of Hygiene, with assistance from members of his or her council, most of whom come from our institute.

Most companies at present are not concerned about occupational health because they are undergoing transition, and many will be sold. For the many small companies with 300 or fewer employees, there is no regulation that could force the private owner to have the workplace inspected. But this is likely to change. And scientists are likely to have a greater role in development and implementation of policies.

ECONOMIC AND POLITICAL ISSUES IN OCCUPATIONAL HEALTH IN POLAND

Małgorzata Pańkowska
Academy of Economics
Katowice, Poland

This paper is based on research studies entitled "Medical Attention Policy in the State System of Social Policy," conducted by faculty members of the Department of Social Policy, Faculty of Management, Academy of Economics, in Katowice between 1989 and 1991.

Statistical research in Poland has confirmed the high death rate, especially of newborns (nearly 20 per 1000 live births); the short life span, especially for men (67 years); the higher mortality of men, especially those in the productive age groups; and the high rate of disability. Why is the health status of workers in Poland so bad and why does it worsen? What can be done to improve this situation?

The World Health Organization (WHO) describes 12 factors necessary for full health: food provisions and nourishment, education, job conditions, employment, corporate common consumption, savings, transport and communications, housing conditions, clothes, rest recreation and amusement, social insurance, and civil liberties privileges. More frequently, the opinion that the role of health protection is rather small is popularized. Health protection can influence health status of people to a small degree (about 20 percent) but life style (life quality) has more influence on people's health. Unfortunately, the lifestyle of Polish society leaves much to be desired.

Based on numerous social policy studies and on research work of our Department, we conclude that the influence of the above factors is very significant in Poland, although their chronological order and weights are slightly different.

The level of cultural and sanitary education of our society ought to be evaluated as low. Alcoholism, smoking, drug abuse, disregard of safety and hygiene code regulations, irrational lifestyle, and poor nutrition constitute the main risks, especially in heavy industry. Poor working conditions are also important. The character of industry in Poland, where there are branches such as raw materials, coal mining, and metallurgy that use out-of-date technologies, generates very serious consequences for the health and well-being of employees.

Employment of many workers of low cultural and social status causes high rates of morbidity, sick-leave absence (nearly 20 days per year), and disability. Nearly 10,000 workers a year complain of work-related diseases. Excess noise at work causes about 25 percent of these illnesses. The health of young people beginning to work is exceptionally bad and tends to worsen.

People receive disability pensions at younger ages than before; about one-third of the pensions for disability are for persons at under age 30, and 50 percent are for persons under age 39. The main causes of disability are mental illnesses and psychoneuroses. The percent of pensions due to nervous system illnesses is very high; for those under age 39, it is 45 percent. Thus, it is necessary to redirect the health protection activities in widely comprehensive vital environment.

Women who have children work nearly 14 hours daily because they have to spend time on their professional jobs, housework, and care of their children. They are overworked and easily neglect early symptoms of the various illnesses, visiting physicians generally when critical or emergency situations arise. They think only about their children's health, but not their own.

A current concern in Poland is the balance of the demand for and the supply of jobs. During the socialist period, each citizen was forced to work in conditions that were not always consistent with his or her qualifications and psychophysical capabilities. In the period of transformation to a market economy, unemployment is 13 percent of people at productive ages when they are capable of working effectively. Unemployment creates serious stress not only for people who have just lost their jobs but also for workers threatened with losing their jobs. This stress results in adverse health effects. The lack of qualified psychologists and sociologists in industry does not promote appropriate mental therapy. However, there is little appreciation of the role of human factors at work. Human resource management is unknown in Poland.

More and more, the outpatient clinics attached to businesses are facing serious financial difficulties or even being liquidated. For the past 40 years these clinics have provided a wide range of curative, preventive, and rehabilitative services. They had the major influence on the increasing level of health in society. Often, a factory's health services (for example, medical care or nutrition) were an important component of recruitment policy for the firm. Businesses were conscious of the necessity of health protection for their workers and covered the costs of the occupational medical care, adding these costs to the general costs of doing business. Transformation to a market economy with business competition has led to new methods of cost accounting and the reduction of these services at firms. Automatically, this has caused closure of occupational health services. This closure has had major consequences for health protection.

What can be done to achieve better health protection results more effectively and with the implementation of new rational costs accounts? The researchers in our department have concluded:

1. Knowledge about health status of employees and their health risks is incomplete. Up to now, research has included only certain aspects of the complex problems of health status of the populations.

2. The system of health protection of workers, like other health protection systems in Poland, is not very effective or efficient. High expenditures for health services are inconsistent with the effects. Significant reduction of efficiency of occupational health services has occurred recently. Thus far, expenditures for maintenance of occupational health care have come mainly from two sources: the national budget and funds of firms. Proposals support creation of funds to finance occupational health services, with money

coming from a proportional surcharge on firms. Most (70 percent) of these surcharges should remain at the disposal of local government, but the rest should be sent to the Ministry of Health in order to generate a central fund for compensating disproportions in the range of occupational health services in the different parts in the country.

3. Lack of workers' responsibility for their own health and their tolerance of exceptionally difficult working conditions are widely observed, problems of great significance with increasing unemployment and the declining of trade unions in Poland.

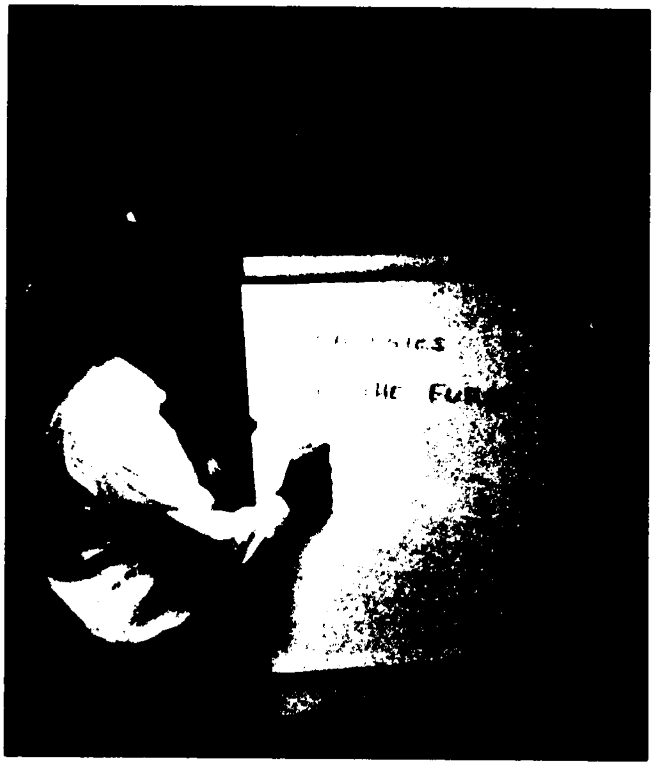
4. It is important to direct the activities of occupational health services to prevention and rehabilitation in a much more significant degree than up to now and simultaneously to transfer treatment from the resident physician to the general practitioner or district medical advisor.

5. The development of vocational guidance agencies and the introduction of psychotechnical examinations are also very important as well as assistance of psychologists and sociologists in the processes of job adaptation.

6. Modernization of the social insurance system is important. The current insurance premium system does not stimulate businesses to improve general conditions of the job environment and to remove safety hazards. Capital expenditures for improvement of working conditions do not lead to improvement of worker health. The alarming increase in disability pensions influences the general costs of businesses, but rates of disability are independent of the level of premiums.

7. Projects of health service reform transform basic health care units (hospitals, laboratories, and outpatient clinics) into non-profit organizations. Such enterprises derive their profits from the selling services to closed populations. Temporarily, these services are to be purchased with local budgets and local funds, but ultimately they will be purchased through sickness insurance. Each firm presents a global budget—a report on global future costs—to the local government in order to receive financial support for its services. This health care unit is to achieve the profit (the difference between total receipts from the allocation and subsidies from all other sources and total expenses). Part of this profit will be placed in a development fund to finance investments, overhauls, and special rewards to the employees.

PART FOUR: CONCLUSION



Barry Levy leads group discussion.

DIRECTIONS FOR THE FUTURE: A SUMMATION BY SYMPOSIUM PARTICIPANTS

Led by
Barry Levy
*Management Sciences for Health**
Boston, Massachusetts, USA

Just before the conclusion of the symposium, participants voiced a number of suggestions for improving the development and implementation of environmental and occupational health policy. These suggestions, which focused on (a) public participation and (b) frameworks for policy development and implementation, are summarized below.

Improving Policy Development and Implementation through Public Participation:

1. Establish New Working Relationships and Strengthen Existing Ones: Establish new trustful relationships among all potential participants in policy development and implementation. This should involve closer cooperation among governmental agencies, academic institutions, businesses, labor organizations, and nongovernmental organizations (NGOs). Stronger relationships should be developed with relevant organizations and individual experts in Western countries who can provide technical assistance and consultation. These relationships should be built on an understanding of the differences among groups and mutual respect among members of different groups.

2. Develop and Provide Educational and Informational Programs and Materials: Provide better information to the public about environmental health issues. Teach schoolchildren about environmental issues, starting at an early age. Educate politicians, lawyers, health professionals, and other key groups in society. In order to maximize educational impact, train trainers to train others. In addition to providing needed information concerning the environment, it is necessary to change people's way of thinking about the environment.

3. Find Ways to Balance Environmental Protection and Economic Development: Demonstrate concrete ways in which environmental protection and environmental health are compatible with economic development, within government and among businesses and industries. Involve international corporations that have experience and expertise in developing ways of balancing environmental protection and environmental health with economic development.

4. Strengthen Democratic Institutions and Processes: Improve the legislative system to give more power to people. Increase independence and freedom for all parts of society. Use mass media effectively. Government leaders need to be more effective in speaking and listening to the

*Dr. Levy is now Professor of Community Health, Tufts University School of Medicine, Boston, Massachusetts, USA.

APPENDIX A
LIST OF SYMPOSIUM PARTICIPANTS

Belgium

Jean-Benoit Burrion, M.D.
Association Europeenne pour le
Developpement et la Sante (AEDES)
34 rue Joseph II
1040 Brussels
Telephone: (32 2) 219 0306
Fax: (32 2) 219 0938

Bulgaria

Fina Kaloyanova, M.D., Sc.D., Ph.D.
Institute of Hygiene and Occupational Health
Bul. Dimitar Nestorov 15
1431 Sofia
Telephone: (359 2) 598 076
Fax: (359 2) 596 071

Croatia

Maja Mastrovic
Program Coordinator
Society for Improvement of Quality of Life
Ilica 72, P.O. Box 117
41001 Zagreb
Telephone: (38 41) 426 352, 278 117
Fax: (38 41) 428 771

Danica Prpic-Majic
Institute for Medical Research
and Occupational Health
2 Ksaverksa cesta, P.O. Box 291
41001 Zagreb
Telephone: (38 41) 221 573
Fax: (38 41) 274 572

Czech and Slovak Federal Republic

Karel Blaha, Ph.D.
National Institute of Public Health
Srobarova 48
100 42 Prague 10
Telephone: (42 2) 738 715
Fax: (42 2) 736 904

Petr Kraus
Odborove Sdruzeni Cech Moravy Slovenska
Hybernska 38
101 00 Prague 1
Telephone: (42 2) 236 7529
Fax: (42 2) 236 7529

Daniela Pelclova, M.D., Ph.D.
Charles University
Department of Occupational Medicine
Vysehradska 49
128 21 Prague 2
Telephone: (42 2) 296 741-4

Tomas Trnovec, M.D., D.Sc.
Director, Institute of Preventive and Clinical
Medicine
Limbova 14
833 01 Bratislava
Fax: (42 7) 373 906

Czech and Slovak Federated Republic, continued

Maria Vargova, M.D., Ph.D.
Head, Department of Toxicology
Institute of Preventive and Clinical Medicine
Limbova 14
833 01 Bratislava
Telephone: (42 7) 374 404
Fax: (42 7) 373 906

Ing. Ondrej Velek
Czech Society for Environment
Section for Wastes
Nasypu 3
152 00 Prague 5
Telephone: (42 2) 733 113, 534 939
Fax: (42 2) 735 904
E-mail: Velek.Ondrej@ECN.GN.APC

Jaroslav Volf, M.D.
Director
Regional Institute of Hygiene
Partyzanske nam. 7
729 92 Ostrava 1
Telephone: (42 69) 214 252
Fax: (42 69) 225 165

Denmark

Francis LaFerla, M.D., M.Sc., Dip.S.H.
Regional Advisor for Occupational Health
World Health Organization
Regional Office for Europe
8 Scherfigsvej
DK 2100 Copenhagen
Telephone: (45 39) 17 17 17
Fax: (45 31) 18 11 20

Martin Silberschmidt, M.D., Ph.D.
Euro Health Group
Vestre Strandalle 76
DK 8240 Risskov
Telephone: (45 86) 17 36 90
Fax: (45 86) 17 80 33

France

Philippe Vinard, M.P.A.
Graduate Student
Harvard School of Public Health
2 rue Augusta
92160 Antony
Telephone: (33 1) 46 66 09 94

Ruth Zilkha, M.Sc.
The Health Foundation
72 rue Saint Louis en l'Ile
75004 Paris
Telephone: (33 1) 46 33 01 23
Fax: (33 1) 43 26 49 60

Hungary

Ferenc Bokros
Public Health Institute
P.O. Box 186
3501 Miskolc
Telephone: (36 46) 354 611
Fax: (36 46) 358 060

Illes Desi, M.D., Ph.D., D.Sc.
Professor and Head
Department of Public Health
Albert Szent-Gyorgyi
University Medical School
Dom ter 10
6720 Szeged
Telephone: (36 62) 11 954
Fax: (36 62) 11 954

Hungary, continued

Gyula Dura, Ph.D.
National Institute of Hygiene
Department of Toxicology
Gyali ut 2-6
1097 Budapest
Telephone: (36 1) 114 2250
Fax: (36 1) 133 0148

Karoly Fulop
Federation of the Chemical Workers' Unions
VDSZ, Pf. 29
1406 Budapest
Telephone: (36 1) 142 5934 or 122 0419
Fax: (36 1) 142 9975 or 122 0419
E-mail: hungchem@geo2.geomail.org

Zsuzsanna Fuzesi, M.D.
Assistant Professor of Sociology
Medical University of Pecs
Szigeti ut 12
7624 Pecs
Telephone: (36 72) 24 122
Fax: (36 72) 26 244

Sarolta Gundy, Ph.D.
National Institute of Hygiene
Department of Human Genetics
Gyali ut 2-6
1097 Budapest
Telephone: (36 1) 114 2250
Fax: (36 1) 133 5773

Olga Kekesi, M.D.
Green Future Environment Association
Tuzliliom u.5.III.16
1223 Budapest

Istvan Ori
Institute for Environmental Protection
Department for Air Pollution Abatement
Aga u. 4
1113 Budapest
Telephone: (36 1) 181 1350 x30
Fax: (36 1) 161 1420

Peter Rudnai, M.D.
Head, Department of Community Hygiene
National Institute of Hygiene
Gyali ut 2-6
1097 Budapest
Telephone: (36 1) 114 2250
Fax: (36 1) 133 0148

Gyorgy Ungvary, M.D., Ph.D., D.Sc.
Director
National Institute of Occupational Health
Nagyvarad ter 2
P.O. Box 22
1450 Budapest IX
Fax: (36 1) 113 6891

Lithuania

Limas Kupcinskas, M.D.
Vice Dean
Department of Pulmonary
and Occupational Diseases
Kaunas Medical Academy
Mickeviciaus 9
3000 Kaunas
Telephone: (7 0127) 226 110
Fax: (7 0127) 220 733

Davidas Schupakas
Republican Hygiene Centre
153 Kalvorijus str.
2042 Vilnius
Telephone: (7 0122) 769 964
Fax: (7 0122) 765 281

Zenonas Stanevicius
Director
Republican Hygiene Centre
153 Kalvorijus str.
2042 Vilnius
Telephone: (7 0122) 778 941
Fax: (7 0122) 765 281

Netherlands

Michal Krzyzanowski, Sc.D.
Environmental Epidemiologist
European Centre for Environment and Health
World Health Organization/EURO
Antonie van Leeuwenhoeklaan 9
P.O. Box 1
3720 BA Bilthoven
Telephone: (31 30) 295 323

Poland

Krysztof Benczek
Central Institute for Labour Protection
ul. Tamka 1
00-349 Warsaw
Telephone: (48 22) 268 772

Maria Bninska
Voice of America
al. Waszyngtona 2B/38
03-910 Warsaw
Telephone: (48 22) 174 395

Barbara Cieslicka
c/o Central Institute for Labour Protection
ul. Tamka 1
00-349 Warsaw
Telephone: (48 22) 268 772

Professor Tadeusz Dutkiewicz
Nofer Institute of Occupational Health
ul. Teresy 8
91-345 Lodz
Telephone: (48 42) 552 505
Fax: (48 42) 348 331

Dr. Piotr Glinski
Polish Academy of Sciences
Institute of Philosophy and Sociology
ul. Nowy Swiat 72
00-330 Warsaw

Dr. Pawel Gorynski
National Institute of Hygiene
Department of Medical Statistics
ul. Chocimska 24
00-791 Warsaw
Telephone: (48 22) 497 725

Dr. Zbiginiew Halat, M.D.
Deputy Minister
Ministry of Health and Social Welfare
ul. Miodowa 15
00-923 Warsaw

Professor Janusz Indulski, M.D., Ph.D.
Director
Nofer Institute of Occupational Health
ul. Teresy 8
91-345 Lodz
Telephone: (48 42) 552 505
Fax: (48 42) 348 331

Professor Wieslaw Jedrychowski, M.D., Ph.D.
Medical Academy
Department of Epidemiology
ul. Kopernika 7
31-034 Krakow
Telephone: (48 12) 228 795
Fax: (48 12) 228 795

Dr. Jerzy Karski, M.D., Ph.D., F.I.C.S.
Head, Department of Health Protection
National Centre for Health System Management
ul. Dluga 38/40
00-238 Warsaw
Telephone: (48 22) 635 3620
Fax: (48 22) 314 712

Poland, continued

Professor Henryk Kirschner, M.D.
Head, Institute of Social Medicine
Warsaw Medical School
and Director, National Center for Health System Management
ul. Ocski 3
02-007 Warsaw
Telephone: (48 22) 312 137, 312 124, 215 256
Fax: (48 22) 314 712, 257 300

Professor Maria Konarska
Central Institute for Labour Protection
ul. Tamka 1
00-349 Warsaw
Telephone: (48 22) 268 772

Professor Jan Kopczynski
Institute of Social Medicine
Warsaw Medical School
ul. Ocski 3
02-007 Warsaw

Jerzy Kopias
Nofer Institute of Occupational Medicine
ul. Teresy 8
91-345 Lodz
Telephone: (48 42) 552 505
Fax: (48 42) 348 331

Professor Cezary Korczak
President
Polish Society of Hygiene
ul. Karowa 31
00-324 Warsaw

Mgr. Irene Kosinska
Institute of Social Medicine
Warsaw Medical School
ul. Oczki 3
02-007 Warsaw

Boleslaw Krzysztofik
Warsaw Medical School
ul. Oczki 3
02-007 Warsaw

Professor Dr. Jozef Kwiatkowski, C.E.
Prorector, Warsaw Technical University
ul. Lukasiewicza 17
09-400 Plock
Telephone: (48 22) 449 752 (home)

Dr. Cezary Macura
Institute of Mother and Child
Department of Epidemiology
ul. Polna 3B
34-410 Rabka

Professor Stefan Maziarka
Deputy Director
Head, Department of Environmental Health
National Institute of Hygiene
ul. Chocimka 24
00-791 Warsaw

Dr. Bohdan Michalski
Chemical Expert
National Labour Inspectorate
ul. Kopernika 36/40
00-924 Warsaw

Dr. Lucjan Mochowski
National Labour Inspectorate
ul. Kopernika 36/40
00-924 Warsaw

Malgorata Pankowska
Academy of Economics
ul. 1-go Maja 50
40-226 Katowice

Jan Rzepecki
Central Institute for Labour Protection
ul. Tamka 1
00-349 Warsaw
Telephone: (48 22) 268 772

Mgr. Andrzej Skowronski
Polish Academy of Sciences
Centre for Raw Material and Energy Management
ul. Wybickiego 7
30-039 Krakow

Professor Jan Sobotka, Ph.D.
Institute of Social Medicine
Warsaw Medical School
and General Secretary of the Board
Polish Society of Hygiene
ul. Ocski 3
02-007 Warsaw

Poland, continued

Professor Jerzy Sokal, D.Sc.
Institute of Occupational Health
ul. Koscielna 13
41-200 Sosnowiec
Telephone: (48 32) 660 640
Fax: (48 32) 661 124
Telex: 312767 imp pl

Tadeusz Sulkowski
Director
National Labour Inspectorate
ul. Kopernika 36/40
00-924 Warsaw

Dariusz Ulatowski
Regional Inspectorate of Environmental Protection
ul. Metalowcow 2
31-537 Krakow

Dr. Bohdan Wasilewski, M.D.
National Centre for Health System Management
ul. Dluga 38/40
00-238 Warsaw
Telephone: (48 22) 635 3620
Fax: (48 22) 314 712

Dr. Bogdan Wojtyniak
National Institute of Hygiene
ul. Chocimska 24
00-791 Warsaw

Romania

Eugen S. Gurzau, M.D.
Institute of Public Health and Medical Research
Louis Pasteur str. 6
3400 Cluj
Telephone: (40 51) 18 252

Ing. Agneta Liebmann
Environmental Surveillance and Protection Agency
Boul. Mihail Viteazul nr. 32
Timisoara
Telephone: (40 61) 113 438
Fax: (40 61) 113 438

Ildiko Uray
Institute of Hygiene and Public Health
Louis Pasteur str. 6
3400 Cluj-Napoca
Telephone: (40 51) 118 252/126
Fax: (40 51) 118 365

Eniko Viragh, M.D.
Institute of Public Health and Medical Research
Louis Pasteur str. 6
3400 Cluj
Telephone: (40 51) 118 252

Russia

Dr. Vladimir Lupandin
Director, Program on Environmental Issues
Center of Independent Ecological Programs
Krzhizhanovskogo 24/35
Building 5
117259 Moscow
Telephone: (7 095) 125 8088
Fax: (7 095) 128 9161

Slovenia

Metoda Dodic-Fikfak, M.D.
Institute of Public Health and Social Welfare
Trubarjeva 2
61000 Ljubljana
Telephone: (38 61) 123 245
Fax: (38 61) 323 955

Davor Lovincic, dipl. ing., M.S.
Institute of Public Health and Social Welfare
Trubarjeva 2
61000 Ljubljana
Telephone: (38 61) 123 245 or 212 904
Fax: (38 61) 323 955

Metka Macarol-Hiti
Ministry of Health
Sanitary Inspectorate
Parmova 33
61000 Ljubljana
Telephone: (38 61) 320 743
Fax: (38 61) 322 284

Ukraine

Eugene N. Antipenko, M.D.
Chief, Laboratory of Genetic Consequences of Environmental Degradation
Marzeev Research Institute of General and Community Hygiene
Popudrenko str. 50
252160 Kiev
Telephone: (7 044) 552 1310, 559 1466

Leonard Dobrovolsky, M.D.
Director, Department of Medical and Scientific Information
Institute for Occupational Health
75, Saksagansky st.
252033 Kiev
Telephone: (7 044) 220 8030
Fax: (7 044) 220 6677

Yuri Kundiev, M.D.
Director
Institute for Occupational Health
75, Saksagansky st.
252033 Kiev
Telephone: (7 044) 220 8030
Fax: (7 044) 220 6677

Mykola G. Prodanczuk, M.D.
Head, Medico-Ecological Institute
Ministry of Public Health
Phedcovich str. 30
274022 Chernivtsi
Telephone: (7 03722) 36 365
Fax: (7 03722) 37 110
Telex: 234168 wiwat su

United States

Michael Adamkiewicz, M.S.
The Pennsylvania State University
P.O. Box 10891
State College, PA 16805
Telephone: (814) 863 7608

Janusz Bajsarowicz, P.E.
President, U.S. Committee On Poland's Environment, and
AQUA Resources, Inc.
Consulting Environmental Engineers
Berkeley, CA

Monica M. Becker
Research Associate, Risk Analysis Group
Tellus Institute
89 Broad Street
Boston, MA 02110
Telephone: (617) 426 5844
Fax: (617) 426 7692

Halina S. Brown, Ph.D.
Associate Professor of Environment, Technology, and Society
Clark University
950 Main Street
Worcester, MA 01610-1477
Telephone: (508) 793 7172
Fax: (508) 751 4600

United States, continued

Keith M. Casto, J.D.
Hoge Fenton Jones & Appel
60 South Market Street
San Jose, CA 95113-2396
Telephone: (408) 287 9501
Fax: (408) 287 2583

Carl F. Cranor, Ph.D., M.S.L.
Professor of Philosophy
Associate Dean of Humanities and Social Sciences
University of California
Riverside, CA 92521
Telephone: (714) 787 3572
Fax: (714) 787 4537

Barbara Felitti, M.S.
Environmental Services Department Manager
Thermo Consulting Engineers, Inc.
7 Park Avenue
Williston, VT 05452
Telephone: (802) 879 7733
Fax: (802) 879 1472

Barbara Gerwel, M.D.
Research Scientist
New Jersey State Department of Health
CN360
Trenton, NJ 08625-0360
Telephone: (609) 984 1863
Fax: (609) 984 2218

Holger Hansen, M.D., Dr.P.H.
Professor of Community Medicine and Health Care
University of Connecticut
School of Medicine
263 Farmington Avenue
Farmington, CT 06030-1910
Telephone: (203) 679 3351
Fax: (203) 679 2518

Kim Hooper, Ph.D.
Chief, California Occupational Health Program
California Department of Health Services
2151 Berkeley Way, Annex 11
Berkeley, CA 94704
Telephone: (510) 540 3499
Fax: (510) 540 3472

Beverly Patterson Johnson, M.Ed.
Associate Director for Administration
Toxics Use Reduction Institute
University of Massachusetts Lowell
One University Avenue
Lowell, MA 01854
Telephone: (508) 934 3298
Fax: (508) 453 2332

Joseph LaDou, M.D.
Clinical Professor
University of California
School of Medicine
350 Parnassus Avenue, Suite 609
San Francisco, CA 94143-0924
Telephone: (415) 476 4951
Fax: (415) 476 6426

Paul Landsbergis, Ed.D.
Post-doctoral Fellow in Epidemiology
Hypertension Center
Cornell University Medical College
525 East 68th Street
Starr 416
New York, NY 10023
Telephone: (212) 746 2166
Fax: (212) 746 8451

Charles Levenstein, Ph.D., M.S.O.H.
Professor of Work Environment
University of Massachusetts Lowell
One University Avenue
Lowell, MA 01854
Telephone: (508) 934 3268
Fax: (508) 452 5711

Barry Levy, M.D., M.P.H.
Director, Program for Environment and Health
Management Sciences for Health
400 Centre Street
Newton, MA 02158
Telephone: (617) 527 9202
Fax: (617) 965 2208

Thaddeus Lipien
Voice of America
330 Indepedence Avenue, SW
Washington, DC
Fax: (202) 610 1534

United States, continued

Gwen Lundberg, B.A., B.S.N
Graduate Student
Occupational Health Nursing
and Public Health
University of Washington
2009 McGilvra Boulevard East
Seattle, WA 98112
Telephone: (206) 325 3631

Kenneth A. Mundt, Ph.D.
Assistant Professor
Occupational Epidemiology Unit
School of Public Health
University of Massachusetts
Amherst, MA 01003
Telephone: (413) 545 6167
Fax: (413) 545 1645

John Nagiecki, M.A.
Graduate Student
Department of Sociology
Washington State University
Pollman, WA

Judith Perrolle, Ph.D.
Department of Sociology and Anthropology
Northeastern University
Holmes Hall 500
Boston, MA 02115
Telephone: (617) 437 3861

Charles Prochaska
Occupational Safety and Health Administration
200 Constitution Avenue, NW
Suite N3119
Washington, DC 20210
Telephone: (202) 523 8111

Jane Riggan, M.S.W.
Community Relations Coordinator
California Department of Health Services
Environmental Epidemiology and Toxicology
5900 Hollis Street, Suite E
Emeryville, CA 94608
Telephone: (510) 540 3657
Fax: (510) 540 2673

Helga E. Rippen, Ph.D.
AAAS Diplomacy Fellow
Agency for International Development
R&D/H/CD SA-18, Room 1227
Washington, DC 20523
Telephone: (703) 875 4500
Fax: (703) 875 4686

Mark Robson, Ph.D.
University of Medicine and Dentistry
of New Jersey
681 Frelinghuysen Road
EOHSI Building
Piscataway, NJ 08855-1179
Telephone: (908) 932 0201

Beth Rosenberg, M.P.H.
Graduate Student
Department of Work Environment
University of Massachusetts Lowell
One University Avenue
Lowell, MA 01854
Telephone: (617) 491 0732

Eve Spangler, Ph.D.
Associate Professor of Sociology
Boston College
Chestnut Hill, MA 02167
Telephone: (617) 552 4146

Marsha Spitzer, B.A.
Senior Program Assistant
Program for Environment and Health
Management Sciences for Health
400 Centre Street
Newton, MA 02158
Telephone: (617) 527 9202
Fax: (617) 965 2208

Daniel Thau Teitelbaum, M.D.
Medical Toxicologist
Medical Toxicology Partnership
155 Madison Street
Denver, CO 80206
Telephone: (303) 355 2625
Fax: (303) 355 3361

United States, continued

James Tramel, M.P.H.
Director of Toxics Prevention
Tennessee Environmental Council
1700 Hayes Street
Nashville, TN 37203
Telephone: (615) 321 5075
Fax: (615) 321 5082

Charles Weinstein, M.S.
Senior Associate
Conte Institute for Environmental Health
742 North Street
Pittsfield, MA 01201
Telephone: (413) 447 2403
Fax: (413) 447 2203

Jerome Wesolowski, Ph.D.
California Department of Health Services,
University of California, Berkeley,
and Director and Treasurer, U.S. Committee
On Poland's Environment
2151 Berkeley Way
Berkeley, CA 94704
Telephone: (510) 540 2476
Fax: (510) 540 3022

Allen L. White, Ph.D.
Director, Risk Analysis Group
Tellus Institute
89 Broad Street
Boston, MA 02110
Telephone: (617) 426 5844
Fax: (617) 426 7692

John C. Wooding, Ph.D.
Assistant Professor of Work Environment
University of Massachusetts Lowell
One University Avenue
Lowell, MA 01854
Telephone: (508) 934 3296
Fax: (508) 452 5711

APPENDIX B
HOW TO EFFECTIVELY PRESENT OCCUPATIONAL AND ENVIRONMENTAL HEALTH INFORMATION

Helga E. Rippen
Office of Health
U.S. Agency for International Development
Washington, DC, USA

Given the critical nature of scientific findings in the occupational and environmental health field, it is important that the information be available, understood, and used. One method for disseminating this information is through publications such as this; another is through presentations. The purpose of a presentation is to effectively communicate ideas to an audience, be they your colleagues, students, policy-makers, or the general public. Scientists have a different perspective than other professionals and require public-speaking skills. First, the presentation is often prepared with a published document in mind. Instead of focusing and tailoring the subject to an audience, there is a tendency to focus on the written document. Second, the training scientists receive does not include public speaking. Third, there is a lack of guidance. While there are guidelines for document preparation for the author, they are usually lacking for the presenter. Finally, less importance is placed on the oral presentation of scientific information than on the written. Remember, the purpose of a publication is to present your information in print. In contrast, presentations are vocal with visual props—quite a different medium for information exchange.

When discussing presentation styles to scientists a common response is, "I'm not a politician. I don't need gimmicks!" This may be true, but your objectives are the same. When speaking, your objectives are to hold the audience's attention, have them follow what you are saying, and ultimately have them agree with you. This paper will provide some guidelines for presentations, obtained from many sources (see references). These guidelines are introduced by components: (1) Preparation/Organization; (2) Audiovisual/Support Techniques; and (3) Delivery.

Preparation/Organization: Preparation for a talk can be broken down into subcomponents. These subcomponents include time budgeting, planning, gathering and organizing information, outline development, and adding interest.

The first step requires an invitation to give a talk. What do you do now? First, budget your time. Ideally, one should plan to spend 1 hour for every minute of a presentation. This time includes reviewing the objective, researching the topic, organizing your thoughts, writing your script, preparing the audiovisuals, and rehearsing. Roughly half of the time should be devoted to dry runs, revisions, and audiovisuals.

The next step is planning. To do this effectively it is critical that you get the following information: why, who, what, where, when and how.

(1) The **why** answers the critical issue—what is the objective of the presentation (for example, to inform, to sell an idea, to take action). Failure to address this question is the most common cause of a poor presentation.

(2) **Who** is your audience? Will it be scientists, policy-makers, or students? If you are not sure, find out. You need to know your audience in order to keep their attention and address their needs.

(3) **What** does your audience want and/or need to know. What facts are relevant for the audience's comprehension of your talk?

(4) **Where** are you going to be giving your presentation? This will help you plan your traveling. Make sure to take jet lag into consideration.

(5) **When** is your talk scheduled? This lets you budget your time so that you can have enough time to prepare for your talk.

(6) **How** will you be presenting it? What sorts of audiovisuals will you be showing. Will it be a lecture, a presentation, a summary, or a panel discussion?

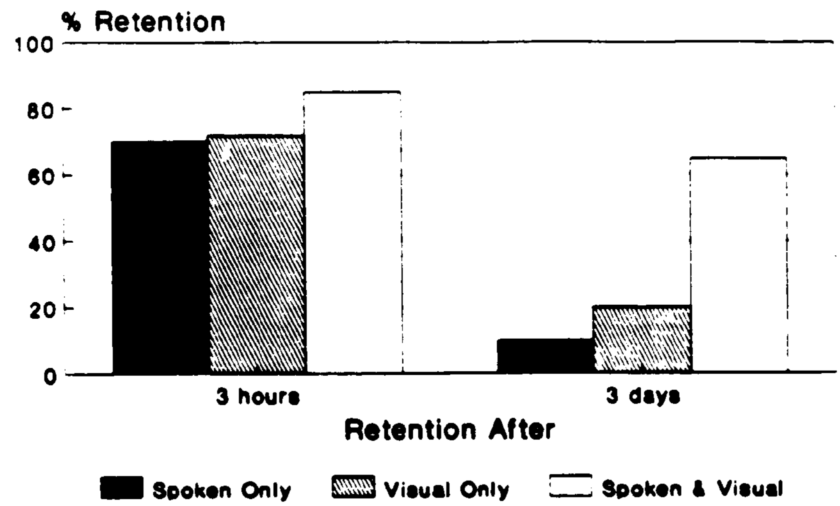
These questions are intended to help you focus on what it is you are trying to accomplish during your presentation. It will also help you maximize your impact by understanding your audience.

Next, gather information on the subject you will be discussing. This can include background papers, data, or other information. Sift through your information several times during the preparation process. Get rid of excess information! An outline can help you sort the information out into discrete categories. For scientific presentations, a general outline includes statement of problem, methods, results, conclusions, and recommendations. But remember there are others ways of presenting. Developing an outline is helpful because it provides a framework, gives direction, provides a checklist, directs emphasis, and is easily reviewed.

Don't forget to add interest into your presentation. Make an impression; why it is important for the audience to listen to what you have to say. Repetition is important. Repeat, repeat, and repeat (say it in different ways). Next make an association—start on common ground. This is why it is critical to know your audience. You can start with what is already agreed upon and build up your argument from there.

Now it is time to review your presentation. Does the organization follow the strategy you have in mind? Does ALL the material fit the objective of the presentation? How about the main points, are they in proper sequence, are they balanced? Are you unnecessarily duplicating anything? Do you have enough information? Can you acknowledge conflicting views and refute them? Can you persuade the audience to your point of view? What's new—does the audience already know this?

Figure 1: The Relationship between Retention and Type of Presentation



It helps to provide a good opening remark and strong conclusion. In the introduction, you need to first get your audience's attention. Add appeal—why should they be listening to you? Then introduce the central thought (objective) of your presentation. The conclusion should alert the audience that the talk is almost over. It should appeal to the group. Remember to repeat the central thought and summarize the main point. End with a memorable final statement.

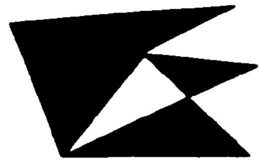
Audiovisuals/Support Techniques: As a well-known saying goes, "A picture paints a thousand words." This is especially important to remember when addressing an audience whose language expertise is different from the official conference language. Visuals also add to retention, as shown in Figure 1.

An often cited "main" cause of a poor presentation is too few visuals and too much detail. Scientists often use overheads of figures they have published. This means that they are hard to read since they are meant to be read and not discussed during a presentation. A simple rule is: keep it short and simple; large and legible! Follow the "6x6" rule—no more than 6 lines of type with no more than 6 words on a line.

Visuals are used to arouse interest, encourage audience participation, prevent misunderstandings, persuade, focus attention, save time, reinforce ideas, add humor, enhance credibility, and explain the inaccessible. There are many publications available that provide tips on how to make the most effective presentations. One summary of rules from Paller et al. is shown in Table 1. These and others can be found in more detail in the references.

Table 1: Rules for Effective Chart Design	
1	Use well-designed charts for all your graphics.
2	Determine what relationships you want to show or what point you want to make before choosing the chart.
3	Make your curves thicker than your grids.
4	Label your curves if there is room.
5	Write your axis labels horizontally.
6	Make your axis numbers large enough to read easily.
7	Use the same scales when you use multiple charts to compare trends.
8	Include zero when comparing levels or totals.
9	When you omit zero, let your reader know.
10	Use scales that make interpolation easy (add tick marks, if necessary).
11	Use different line thicknesses or different line patterns with long dashes for comparing yearly data. (Save dashed lines and dotted lines for projections or extensions.)
12	Limit pie charts to five or fewer segments.
13	Make bars and columns wider than the space between them.
14	Order your shade patterns from darkest to lightest.
15	Put labels in shaded areas of surface charts, when bands are wide enough.
16	Order data on surface charts so that irregular layers do not distort smoother upper layers.
17	Avoid semilog (ratio) scales for audiences that are unfamiliar with them.
18	Order shade patterns on map scales to facilitate remembering which ones reflect the scale ends.
19	Do not allow grid lines to pass through columns or bars.
20	Avoid garish shade patterns.
21	Use a single family of type on a chart; try to maintain consistency of type of styles from chart to chart in a presentation. Simple sans-serif fonts are preferable.

Figure 2: Storyboard



Schematic 1

This is an example of a storyboard. The text in this region goes with the visual shown above in the box. The text can be an outline, talking points, or the text that is to be read. This technique ensures the linkage between the text and the visuals.

Delivery: What makes a good delivery? Practice, practice, and more practice! If you read your presentations, try to look up as much as you look down. Look up at natural places, at the end of a paragraph or sentence. Have your manuscript typed and placed below a reduced version of your visual—this arrangement is known as a story board (see Figure 2).

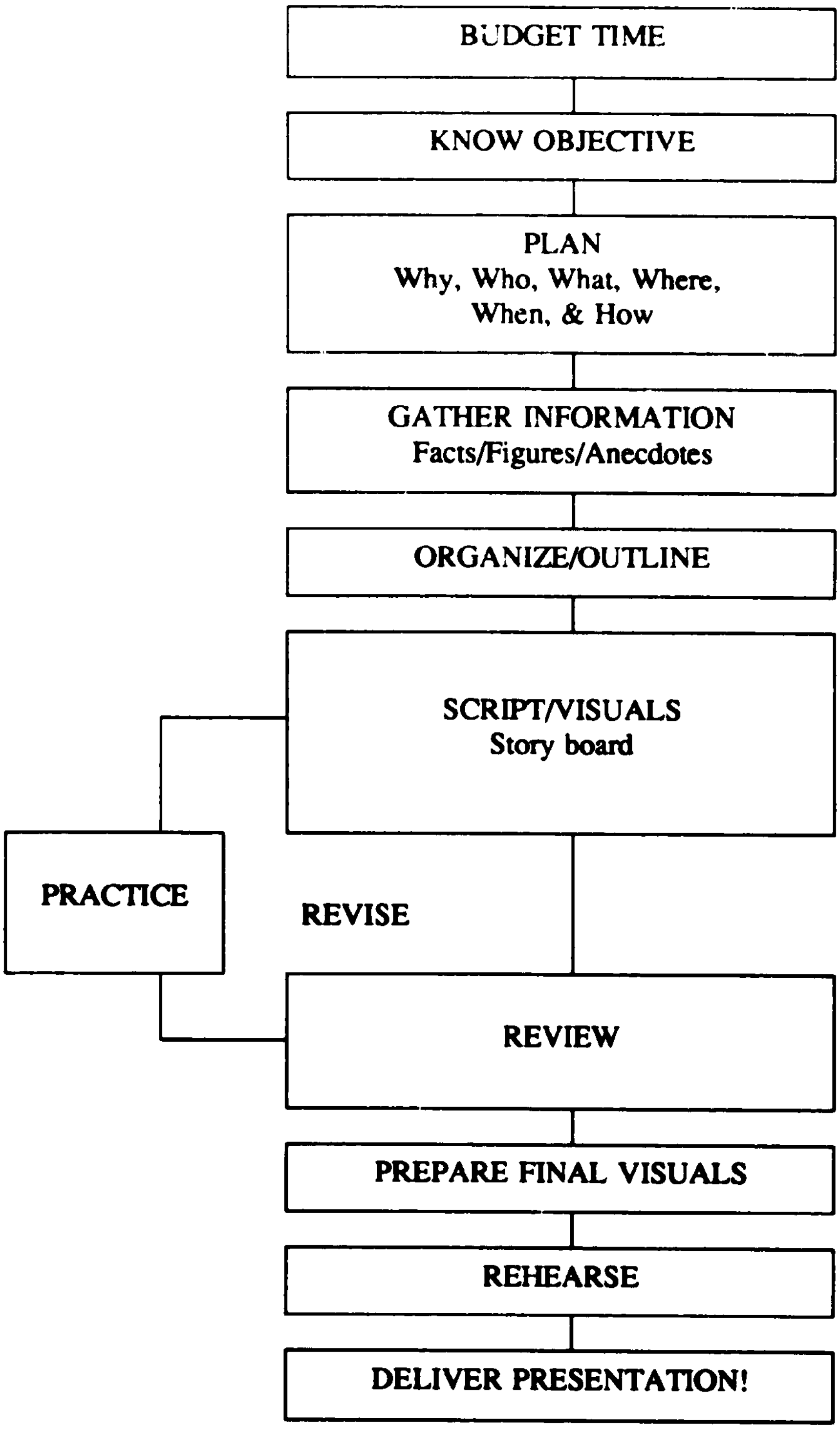
Talk naturally, talk loud. Gesticulate—don't look like a mannikin! The audience will be looking for gesturing, eye contact, body motion, facial expression and posture. They will be listening for inflection, pause, tone and volume, pronunciation, "ums", "ahs", jargon, simple words and sentences, and humor. Try out your presentation in front of a mirror and then your colleagues. Tape your practice sessions.

Summary: This has been a brief overview of guidelines for giving an effective presentation. A summary of the steps involved in presentation preparation is shown in Figure 3. Remember, a key to a great presentation is following the 4S formula: shortness + simplicity + strength (active verbs) + sincerity = a good talk. To summarize, what makes an awesome speaker? A topic that sparks interest, appearance, class, dynamic and interactive format, vocal animation, movement, content, intelligence, notable visuals and finally—tangible, take home value.

REFERENCES

1. Bower, S. 1986. Painless Public Speaking. England: Thorsons Publishing Group.
2. Paller, A., Szoka, K., and Nelson, N. Choosing the Right Chart. ISSCO Graphics.
3. Rinderer, N. 1991. "A Guide to Good Overhead". Performance & Instruction, March, pp. 26-32.
4. Smith, Terry C. 1991. Making Successful Presentations, 2nd. ed. New York: John Wiley & Sons, Inc.
5. Zelazny, Gene. 1982. Choosing and Using Charts. Sara Roche, Gene Zelazny, McKinsey and Company, Inc.

Figure 3. Summary



INDEX

THE UNITED STATES - CENTRAL AND EASTERN EUROPE EXCHANGE FOR ENVIRONMENTAL AND OCCUPATIONAL HEALTH

The United States - Central and Eastern Europe Exchange for Environmental and Occupational Health, comprised of scientists, policy-makers, and others, has as its purpose the strengthening of environmental and occupational health policies and programs in Central and Eastern Europe. The symposium on "Policies, Programs, and Public Participation" was its third major conference in the region.

The Exchange, in cooperation with international, governmental, and nongovernmental organizations, as well as academic institutions:

- Sponsors conferences and symposia on specific topics of interest in environmental and occupational health.
- Undertakes other activities and projects to facilitate the exchange of science and policy information in environmental and occupational health, including publication of proceedings of conferences and symposia sponsored by the Exchange.
- Facilitates and arranges short- and long-term visits to the United States and to Central and Eastern Europe by scientists, policy-makers, and others to improve knowledge and skills in environmental and occupational health.
- Facilitates joint research activities among Americans and Central and Eastern Europeans in environmental and occupational health.

The Exchange was administered by the Program for Environment and Health of Management Sciences for Health, a nonprofit international health organization whose purpose is to strengthen public health and health care capabilities.

For more information about the Exchange, including the mid-1994 symposium, please contact:

Barry S. Levy, M.D., M.P.H.
Professor of Community Health
Department of Community Health
Tufts University School of Medicine
136 Harrison Avenue
Boston, MA 02111 USA
Telephone: (617) 956-5446
Telefax: (617) 956-7417

Charles Levenstein, Ph.D., M.S.O.H.
Professor of Work Environment Policy
Department of Work Environment
University of Massachusetts Lowell
One University Avenue
Lowell, MA 01854 USA
Telephone: (508) 934-3268
Telefax: (508) 452-5711