

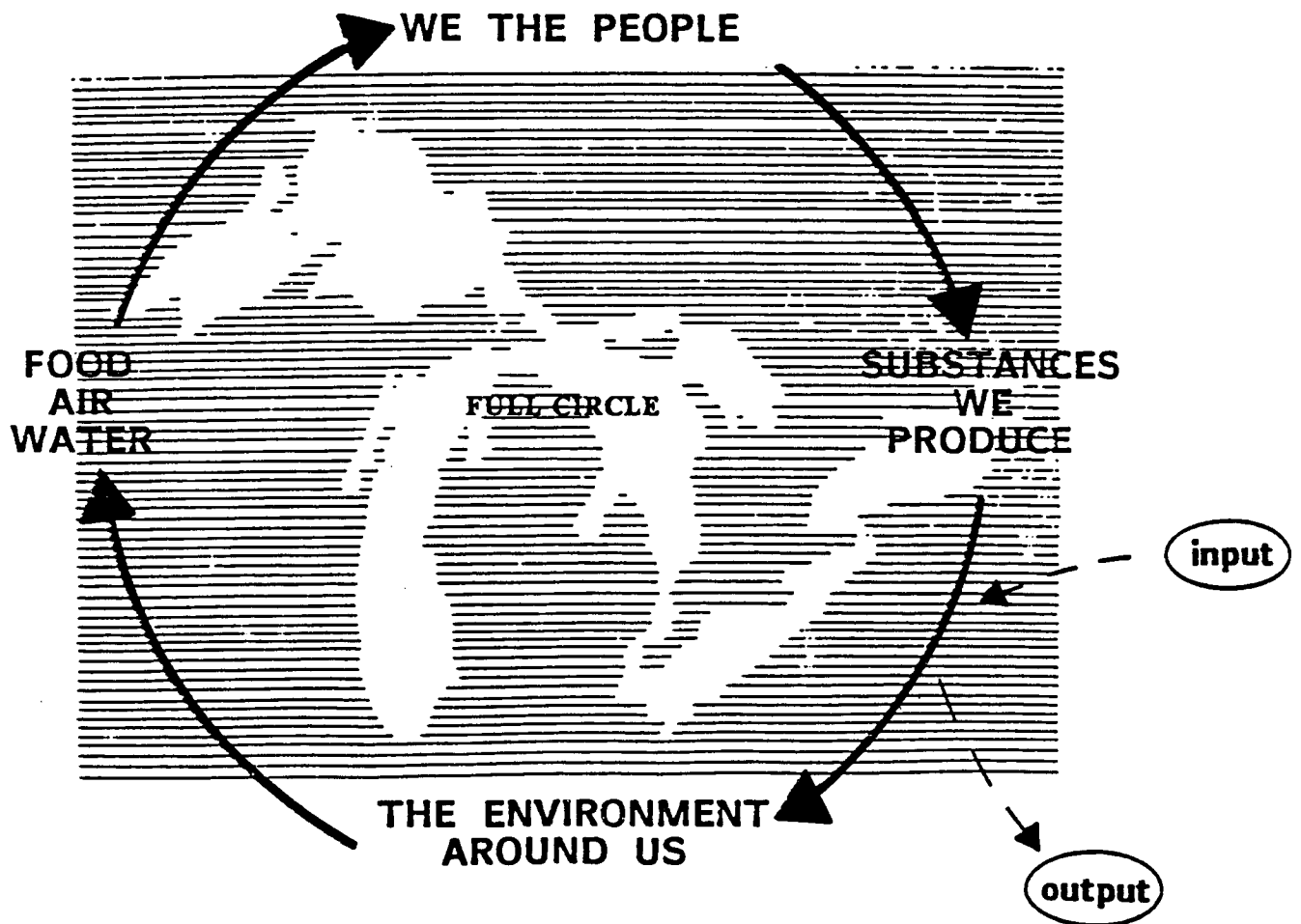
EXECUTIVE SUMMARY

for the

INTERNATIONAL WORKING CONFERENCE

on

Evaluating Risks to Human Health Associated with Exposure to Toxic Chemicals in the Great Lakes Basin Ecosystem



edited by

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PREFACE

More than sixty professionals have contributed to the preparation of this Executive Summary, which lists a series of significant recommendations for action in areas of policy, education and research related to the issue of chemicals in the Great Lakes environment and the potential risks to human health posed by exposure to these chemicals. Readers will be impressed with the way these professionals have integrated many disciplinary perspectives into a comprehensive implementation agenda that targets the seeking of solutions to problems revolving around the human health issue. We are indebted to these persons and acknowledge them in the final pages of this document, in conjunction with their particular TASK GROUP assignment. The Great Lakes Program of the State University of New York (SUNY) at Buffalo now bears an obligation to carry forward these recommendations to governments, organizations, and individuals in both Canada and the U.S. so that the value of each participant's work is enhanced and its significance realized.

The main role of SUNY at Buffalo in this effort has been to facilitate the coming together of individuals from governments, universities, industries, and public special interest groups in both Canada and the U.S. to collectively deliberate this subject. The process did not arise in response to a charge from any organization, nor is it designed to report to any particular body, other than governments and the public at large. The common thread that unites all who have participated is a need to evaluate human health risk associated with exposure to toxic chemicals in the Great Lakes Basin Ecosystem.

This Executive Summary represents a unique collection of recommendations and strategies that can be enacted and demonstrates a spirit of innovative thinking on the part of all who have participated. The ideas presented represent an integrative summary by the editor of the conclusions and recommendations put forth by all participants in the process. I hope that readers will find this document informative and thought-provoking. Additional information about the recommendations contained herein can be found in the individual TASK GROUP reports from the International Working Conference. A compendium of these TASK GROUP Final Reports is available for reference. It can be obtained from the Great Lakes Program, SUNY at Buffalo, upon request.

I am personally indebted to the following persons who served on a Coordinating Committee which planned and guided this inquiry via the conduct of the International Working Conference: Jack Vallentyne (Chair), Canadian Department of Fisheries and Oceans; James Blascovich, the State University of New York (SUNY) at Buffalo; Barry Boyer, SUNY at Buffalo; Ineke Neutel, Canadian Department of National Health & Welfare; John Vena, SUNY at Buffalo; and Phillip Weller, Great Lakes United.

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EVALUATING RISKS TO HUMAN HEALTH ASSOCIATED WITH EXPOSURE TO TOXIC CHEMICALS IN THE GREAT LAKES BASIN ECOSYSTEM

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INTRODUCTION

Clean, usable water resources are essential to the quality of life which makes the Great Lakes region an attractive place to live and do business. The contamination of Great Lakes water and sediments with toxic chemicals, however, threaten this quality of life. The presence and continued introduction of these long-lived chemicals in the Great Lakes Basin Ecosystem is an ongoing concern. Knowledge of human health risks from toxic chemical exposure, however, is fragmented and incomplete. This contributes to public confusion and adds to the scientific uncertainty.

The Great Lakes Program of the State University of New York (SUNY) at Buffalo undertook to establish a bi-national project in 1988, consistent with the tenets of the then recently produced World Health Organization (WHO) philosophy on health promotion. The WHO has as a goal to improve health while simultaneously de-escalating health care costs. The success of this approach pivots on people helping themselves to prevent illness and defer dependency. Governments' role in this is to empower stakeholder groups to deal with issues at hand. SUNY sought to implement this model at the regional level in response to inadequate actions to address toxic chemicals in the Great Lakes Basin Ecosystem.

The International Working Conference was designed to allow participants to share scientific and societal viewpoints and to seek a common ground of understanding. The main questions considered by the 66 Conference attendees included: **ARE THERE THREATS TO HUMAN HEALTH FROM TOXIC CHEMICALS IN THE GREAT LAKES BASIN ECOSYSTEM? IF SO, WHAT ARE THEY AND HOW CAN THEY BE MITIGATED WITH RESPECT TO POLICY, EDUCATION, AND RESEARCH?** In seeking answers through their collective thinking, Conference participants were asked to address the following:

1. identify obstacles impeding timely development of solutions;
2. reconcile an approach to solving problems with the public's need to incorporate social values and political factors into the evaluation of risk; and
3. define a process, through recommendations, that reduces public confusion and distrust, and leads to common understanding and action in the face of exposure to toxic chemicals.

Participants from the U.S. (44), Canada (21) and the Mohawk Nation (1), including people from industry (5), governmental agencies (23), public special interests (6), and academia (32), concluded this 4-day-long consensus-building working conference on October 3, 1989. The group reached consensus in terms of recognizing the extent of Great Lakes Basin Ecosystem problems, and in terms of priority approaches to resolving them. The final step in presenting a comprehensive action plan to governments lies in developing the cost estimates associated with a ranked list of recommendations. **ESSENTIALLY, THE CONFERENCE IS CALLING FOR ACTION THAT WILL ASSURE THE SAFETY OF SOCIETY ON THE BASIS OF EXISTING INFORMATION.**

Conference attendees interacted in a personal and professional capacity, rather than as representatives of more traditionally recognized interest groups. An attempt was made to ensure representation from all sectors of society. If any bias was operating through this process, it worked in favor of the health and long-term viability of the region.

RECOGNIZING THE THREAT

CONSENSUS WAS REACHED BY ALL CONFERENCE PARTICIPANTS ON THE FOLLOWING.

"PERSISTENT TOXIC CHEMICALS (including some metals), DUE TO THEIR NATURE (ability to cross the placenta, to bioaccumulate, to occur as mixtures, possessing long half-lives and toxic properties), POSE THREATS TO THE HEALTH OF PEOPLE WHO LIVE IN THE GREAT LAKES BASIN".

Infants, mothers, the elderly, and consumers of large quantities of some fish and wildlife are more threatened than other members of society. The exact and precise magnitude of the threat is uncertain, but that uncertainty should not be an impediment to actions aimed at reducing risk.

Consider the following:

- o Some toxics are found in water, in sediments, and in fish tissue at levels that exceed standards, criteria or guidelines established by regulatory agencies to protect human health and regulatory agencies advise against the consumption of some fish.
- o There is abundant evidence that toxics in concentrations found in parts of the Great Lakes area cause adverse effects in fish and wildlife (developmental, immune suppression, biochemical, carcinogenic, behavioral, reproductive, and other chronic or occasionally acute toxicity effects). Because of biological similarities at the cellular level in all vertebrates, we expect that humans also may develop a toxic response to contaminants.
- o There is some epidemiological evidence supporting the view that toxic chemicals in the Great Lakes Basin Ecosystem may cause adverse effects in people.
- o Toxic chemicals in the Great Lakes Basin Ecosystem are perceived as a threat to human health. This perception of threat may itself result in adverse health effects and may lead to serious repercussions on the economy and lifestyles of affected populations.

IF SOMETHING CAN ACT AS A TERATOGEN (causing developmental malformations) IN SIX OR SEVEN DIFFERENT SPECIES OF GREAT LAKES FISH & WILDLIFE, IT WOULD BE SHORT-SIGHTED TO SAY THERE IS NO POSSIBILITY THAT THE SUSPECTED SUBSTANCE CAN ACT AS A TERATOGEN IN HUMANS. This linkage between health of aquatic biota in the Great Lakes and human health should serve to guide future action.

Humans are exposed to toxic chemicals through numerous pathways, including the food they consume, the air they breathe, and the water they drink. The consumption of food is considered to be the major pathway of exposure. Great Lakes fish and wildlife can contribute significantly to this pathway. The extent to which contamination of the Great Lakes threatens health is becoming clearer as new and innovative research is completed. "Risk" and "threat", however, mean different things to different people. Clearly there exists a risk to health because there are no zero risks. Acceptability of the risk is a public decision rather than a scientific decision. It is important to view this risk in relation to both individual exposure and the toxicity of contaminant materials.

The concern regarding threats to human health from toxic chemicals in the Great Lakes Basin Ecosystem is fundamental to international cooperation and remediation. Addressing these threats requires a concerted interdisciplinary effort in respect to policy, education, and research. The challenge is to build bridges between disciplines, break down barriers to interdisciplinary collaboration, and provide information for all members of society.

Based upon a consensus regarding the threat of toxic chemicals, all Conference participants recommend that:

the International Joint Commission take steps now to establish a protocol for, and encourage a common approach to, human health risk assessment and risk management for use by regulatory agencies in the Great Lakes Basin.

It would not be wise to wait for science to measure the full extent of the threat to health before we act. We know enough now to accelerate efforts to reduce environmental contamination and to remediate polluted areas. Knowing more is only significant in terms of fine-tuning our actions. Delayed actions could result in increased exposures to contaminants and the exceeding of, as yet undefined, tolerance to critical states.

POLICY IMPLICATIONS

There are scientific unknowns and uncertainties about the workings of nature, the impacts of technology, ambiguities about the likelihood of possible alternative outcomes, limits on resources that could be applied to manage the risks, and differences of opinion on strategies and preferences among people about how risks should be managed. Therefore, risk assessment is not completely objective and risk management decision-making is not a simple act of risk minimization or elimination.

Risk management is often driven by the requirement to comply with regulatory constraints. Consequently, money, time and manpower for achieving objectives are apportioned based on the justification and merits of the risk management activity, in the context of the overall condition of the Great Lakes Basin and its perceived priorities. Risk assessment, however, should not be the sole basis upon which managers initiate actions to control and reduce toxic substances in the Basin. The nature of hazard identification and risk assessment is such that different disciplines and regulatory groups frequently reach very divergent conclusions (both between regulatory groups as well as within regulatory groups). The reason for this inconsistency lies in the necessity to include subjective judgement and interpretation in the assessment procedure. This is particularly true for the handling of uncertainty. Differences in judgement and in selecting strategies to reduce uncertainty can become a basis of frustration for the general public as well as for the regulated community.

Effective risk management and appropriate public policy requires governments to consider a number of factors, only one of which is reflected in the scientific database and health interpretations. For example, issues of cost, benefit, uncertainties, and societal values all require consideration, to varying degrees. Each of these is accompanied by a set of contingencies

and "special concerns" that cannot be simply aggregated. Ultimately the issue of regulation will involve the weighing of values affecting the public. Thus, the public must be involved in all aspects of the regulatory decision.

Therefore, Conference participants unanimously recommend that

U.S. and Canadian federal, state/provincial, local, and native governments develop clear policies on how to deal with risk from exposure to long-lived toxic chemicals, involve a greater audience (early in the process), and present policy for review in a formal setting (e.g. environmental impact studies).

The regulatory process has the ability to reduce potential health threats to society in the Great Lakes Basin Ecosystem, now. It is believed that through effective regulation of point sources, contaminant additions have and can further be reduced. Furthermore, non-point sources can be addressed (albeit more slowly than point sources) by means of legislative and advisory actions, and commensurate funding.

To this end, Conference participants recommend that

key provisions of the Great Lakes Water Quality Agreement relating to ecosystem and human health be codified in U.S. and Canadian law.

Specific deadlines, dates, and benchmarks should be clearly stated in codifying statutes to insure progress towards identified goals.

Conference participants also recommend that

- * **all jurisdictions reaffirm and more aggressively move toward zero discharge of persistent toxic substances to the Great Lakes Basin Ecosystem;**
- * **consistent with the Great Lakes Water Quality Agreement, U.S. and Canadian federal, state/provincial, local and native governments develop common standards for water quality, sediments, and fish body burdens within the Basin; and**
- * **all governments ensure full compliance with existing law, including the remediation of all leaking hazardous waste dumps on a priority basis with, at a minimum, plans for such to be completed by the year 2000.**

Interim action based on full compliance with existing law must proceed in the absence of full information. With regards to fish consumption advisories, where there are differences in advisories, they should be justified. These

advisories should also recognize the special cultural needs of subsistence fishermen and other highly exposed groups.

Conference participants also recommend that

- * **jurisdictions review, by 1994, all point source permits relevant to ambient water quality criteria for aquatic life and that**

- * **domestic legislation be enacted in the U.S. and Canada to regulate atmospheric sources of toxic chemicals more effectively.**

Regulation alone, however, may be unable to address or resolve all identified problems. Certainly this process is not the only means by which it is possible to resolve problems caused by toxic chemical pollution in the Great Lakes Basin Ecosystem. The regulatory process should draw upon and benefit from the observations, participation and recommendations of citizen groups, industries, and political jurisdictions. Education of citizens and regulated industries should foster voluntary efforts in their respective self interests to implement technologies and activities which will reduce or eliminate the introduction or distribution of contaminants within the system.

Contemporary analyses provide alternative ways of thinking about issues of policy, with a consideration for incentives as well as regulations. One alternative approach, generally referred to as sustainable development, starts from the premise that economic activity must, sooner or later, be brought into harmony with the limits of the ecosystems we inhabit. In many ways, present policies encourage waste, and environmental degradation. Subsidies and regulations are often inconsistent with sound environmental policy, (e.g., certain mining wastes and refinery effluents are exempted from some hazardous waste regulations). A political and economic bias towards short-term goals, like profit and growth, preclude longer term environmentally sound choices. A better economic policy would make it unprofitable to carry out business in an environmentally insensitive manner.

Therefore, Conference participants recommend that

U.S. and Canadian federal, state/provincial, local and native governments develop and promote mechanisms that induce changes in the economic structure towards a system of economic incentives and disincentives that promote and enhance the sustainability of the ecosystem and reduce the vulnerability of this system to human intervention.

These manipulations should be viewed as a means to reconcile private interests with the common good.

Another incentive could involve the cooperation of health insurance companies. The public is in need of better information about the potential hazards they may be exposed to and what accumulations of materials may be occurring in their bodies. To obtain information on body burden levels,

however, requires extremely expensive blood serum screening techniques. Insurance companies could be encouraged to begin covering the cost of these screening tools in their regular health care plans, as an "anticipate and prevent" policy, to offset the expense of individuals determining how much at risk they might be by their particular life style. The benefit to the individual would be additional information to change behavior and life style attitudes in order to reduce their risk to exposures. The benefit to the insurance companies would be decreasing the possibility of future health care costs associated with undue and continual exposure to environmental chemicals, where these costs would be realized through occurrence of more traditional symptoms from long-term exposure. Regulatory agencies could also benefit from the information obtained by this screening and adjust their risk management actions in accordance with the exposure levels found in human blood samples.

Therefore, it is further recommended that

governments enhance opportunities for and encourage the policy of reimbursement for screening costs by Insurance Companies in their general health care plans.

This recommendation is contingent upon existence of a state of knowledge that allows high level quality control and assurance in screening protocols.

All Conference attendees indicated the desire that responsible jurisdictions emphasize prevention of problems associated with toxic chemicals in the Great Lakes Basin Ecosystem through pro-active policies, rather than to rely on remediation of problem areas after the fact. Economically, and practically, it is far easier to regulate contaminants at the source of production, rather than to react after their release into the ecosystem. Working Conference participants were in total agreement that we should not wait for damage to occur and then try to fix the situation. Instead, we should use appropriate strategies to prevent the damage from occurring in the first place. To accomplish this task, however, there is a need for additional perceptual and behavioral changes in governments and society. For example, Conference participants were concerned that ethical issues play only a minor role in modern decision making and are too often made subservient to legal issues. We need to consider what is ethical rather than what is legal. We also need to consider what is moral instead of what is permissible.

CONSIDERATIONS FOR COMMUNICATION AND EDUCATION

COMMUNICATION

There is a universal need to improve communication about obstacles, processes and remedies that relate to toxic substances in the Great Lakes Basin Ecosystem. Communication must be inter- and intra-disciplinary, as well as among interested or affected parties. The purpose of information exchange is to empower people, both collectively and individually, to take responsibility for, and control of, the forces which affect their lives.

Messages that need to be communicated include:

1. Definition of risk; risk equals toxicity and exposure.
2. Who/what is at risk?
3. What are the natures of the risks?
4. What are the sources of the risks?
5. What are the magnitudes of the risks?
6. How can the risks be reduced?
7. What are societal implications of the risk reduction options?

Communication of information by public agencies and academic institutions should take into account the cultural context in which this information will be received. Effective communication is not a top-down process. It is multifaceted, in that messages go between all those involved in the process. This means, for example, that not only does the public learn from experts, but that experts learn from citizens as well. Communication must be a dialogue between citizens in the Basin and their elected representatives, public servants and the academic community, where a sharing of ideas occurs which usually results in learning by all participants. Citizens have a right to receive information on toxic chemicals and participate in defining research, prevention, and cleanup priorities.

Therefore, Conference participants recommend that

- * **governments facilitate two-way communication (dialogue) at all levels, both between professionals in different fields and between professionals and the general public and that**

- * **communicators become knowledgeable about all groups involved in the exchange of information and be sensitive to potential consequences that transmission of information may cause to certain groups.**

Even if the transmission of information results in individual or social confusion or disruption, the ethical mandate to keep the public informed remains unchanged. It may be advisable, however, to put risks in the proper perspective and include information on resources that may be useful in mitigating the problems.

Conference participants further recommend that

- * **representatives of technical agencies openly acknowledge the limits of their expertise and knowledge of the issues and**

- * **all jurisdictions evaluate their communication strategies so they will be consistent with the recommendations presented here.**

EDUCATION

Because understanding must be built from the bottom, environmental science is essential at all levels of education (kindergarten to post-graduate). Education on environmental contamination and human health is important because all citizens should understand the link between environmental quality and health and also understand that their own actions can influence both.

Therefore, Conference participants recommend that

environmental science be made part of the core curriculum both in pre-college and undergraduate education.

Because ethical issues play too minor a role in modern decision-making, and are too often subservient to legal issues, participants further recommend that

ethical training be implemented at all levels of education.

Interdisciplinary training is required to aid in the collection of new knowledge. Conference attendees acknowledged that professionals in medicine, as well as in other technical and non-technical fields, are not adequately prepared to deal with the breadth and complexity of environmental contamination and its effects on health. In the medical field, for example, unless clinical physicians are able to properly diagnose and demonstrate harm from certain chemical exposures, public policy mechanisms to legally protect humans are often difficult to develop.

The idea of cause and effect is not often proven in health or related fields of environmental science. Further, despite best efforts, it may never be proven to the satisfaction of legal systems or from the perspective of a statistically significant requirement. Therefore, part of a new education emphasis must be to reverse the burden of proof; i.e., to show that substance "x" does not have a toxic impact before it gets into the environment. Another part of education must be to show how best to develop most likely cause and effect associations and what each discipline may reasonably expect from other disciplines in terms of support and information for this work. Conference participants suggested that there is an urgent need to improve technical education at all levels, so that a whole range of professionals can understand and use basic concepts of environmental science to design experiments, to seek advice and involvement from allied fields, to understand concepts of risk, and to communicate these concepts to others.

To build expertise and research in environmental science, Conference participants recommend that

universities, government, and industry encourage interdisciplinary work, set up interdisciplinary centers, and improve opportunities for interchange of information, ideas, and discussion through the development of cross-disciplinary curricula, internal rewards for interdisciplinary research, and external recognition and funding.

Career teaching posts in environmental health should be established at every major university, especially those with a medical school, as a resource tool to stimulate this cross-disciplinary approach to training.

Conference participants further recommend that

cross-disciplinary training of practitioners occur in medicine and in other professions about research design and interpretation, to enable these professionals to understand the strengths and limitations of scientific knowledge.

Short courses in environmental health should also be instituted to facilitate the ongoing post-graduate education of adult professionals.

RESEARCH NEEDS FOR PROBLEM CHARACTERIZATION & MANAGEMENT

The participants of the Working Conference were unanimous in their opinion that there is clear evidence of harm to the health of natural animal populations from persistent toxic chemicals in the Great Lakes Basin Ecosystem. They further concluded that there is indirect evidence of harm to human populations, though it is much less complete. For this latter reason there is need to further characterize the problem and develop new approaches to managing the problem through additional data gathering. In order to effectively manage the perceived threat, for example, steps must be taken to:

- * reduce the load of toxics entering the system,
- * limit our exposure to toxics, and
- * directly monitor effects of human exposure to toxics to ensure that harmful chemicals are eliminated from the system.

These objectives can only be achieved, however, if we can obtain new research information that will better guide actions to accomplish these steps.

It is essential to identify those substances that are both persistent as well as toxic in the short-term and that pose the greatest risks to human health (individually and through interaction). The classification of materials into "toxic" or "persistent toxic" determines whether the substance is (1) subject to controls on release in toxic amounts or (2) subject to virtual elimination. Several procedures are used by different agencies to evaluate potential risks and classify chemicals. There is however, no agreed single classification procedure and thus no agreement on which are the substances of greatest concern.

Therefore, Conference participants recommend that

existing procedures be evaluated and amended as necessary to produce a harmonious classification system among all jurisdictions.

There are multiple jurisdictions at multiple levels responsible for regulation, research, and management of Great Lakes toxic loadings and exposures. This multiplicity has resulted in inconsistent risk assessment,

risk management and differing levels of permitted discharges of toxic chemicals into the same ecosystem. The inconsistency fosters public confusion about safety and risk, weakens credibility of governments and "experts", and results in inequities in public protection from toxic exposures.

Conference participants were in agreement in recommending that

a concerted effort be put into developing a protocol for collection of additional information that is "key" to characterizing the problem of risk and guiding all governments towards more sound management strategies in the future.

While the Great Lakes area is not the only region whose citizens are subject to toxic chemical exposure, the Great Lakes Basin and its people form a readily accessible ecosystem and population that are at risk. For this reason, the Great Lakes Basin Ecosystem and its people provide a defined region where we can determine general health hazards from these substances.

Therefore, Conference participants recommend that

a state-of-the-art human study be undertaken to evaluate the current risk to humans from exposure to all toxic chemicals in the Great Lakes Basin Ecosystem.

This study should involve a cohort of sufficient size and statistical power to enable subgroup analyses of specific populations at special risk. It should also provide a means of evaluating behavioral information on study subjects as well as a method for passive follow-up that allows for assessment of morbidity, mortality, and reproductive effects in the cohort.

Conference participants further recommend that

a strategy for monitoring programs be developed to provide information on loadings, mass balances and trends in human body burdens of persistent toxic substances in the Great Lakes Basin Ecosystem.

This strategy would provide a "yard stick" for measuring the success of future implemented policies that are designed to seek remedies to the problem.

In order to adequately manage the problem in the future, U.S. and Canadian federal, state/provincial, local and native governments should ensure full compliance with existing law. We should build on our present knowledge about management strategies that seek further action for remediation and protection. Additional analysis will assist in setting priorities according to toxicity and exposure, and with regards to source, which will enable us to track load reduction progress more effectively while more knowledgeably protecting human health.

Therefore, Conference participants recommend that

consistent with the Great Lakes Water Quality Agreement, U.S. and Canadian federal, state/provincial, local, and native governments encourage the collection of new data to modify existing water quality, sediment, and fish body burden standards to be adequately protective of public health.

Data collections should recognize the needs of special cultures and be able to provide guidance on realistic compensatory or mitigatory measures. Fish and wildlife advisory efforts should be reviewed and edited by cultural translators, people familiar with the public, the technical culture and the target group.

Conference participants further recommend that

all jurisdictions develop reliable loading estimates for all sources of toxic chemicals to the Great Lakes and connecting channels.

There are major limitations, however, in measuring progress toward reducing the threat of toxics to humans in the Great Lakes Basin Ecosystem solely on a chemical-by-chemical basis. These limitations include scientific uncertainty about dose-effect relationships and political uncertainty about what the acceptable levels should be. Another problem is the potential additive or synergistic effects among chemicals. In the design and implementation of future assessment strategies to characterize the problem therefore, consideration should be given to an ecosystem approach toward measurement of toxic chemical fate and effect. Only through this approach will we begin to develop more certain knowledge on transport of these hazardous chemicals and harm they represent for ecosystem and human health.

There is increasing public concern that toxic chemicals in the environment threaten human health, with chronic and inter-generational effects engendering particular anxiety. Therefore, in addition to the above cited information needs to manage the environmental contamination problem better, there is a corresponding need to evaluate the social and economic dimensions of this situation. For example, we have inadequate information on the direct and indirect costs accumulating as a result of the presence of hazardous toxic chemicals in the Great Lakes Basin Ecosystem, including the costs of health care secondary to human exposure to toxic substances. Current knowledge regarding the nature, extent, and likelihood of possible links between environmental contaminants and public health, however, suggests that "anticipate and prevent" policies probably have highly significant benefits and payoffs.

An important and integral part of toxic chemical management also involves the consideration of social and economic factors (e.g. cost-benefit, risk-benefit, cost-effectiveness, and social/environmental impact assessment) so that the costs of required research and remedial action can be put in context. This is particularly relevant because hospital, medical, and prescription drug costs are an enormous individual and societal economic burden in North America. In the Province of Ontario, such costs amount to about one-third of

more than 10% of the Gross National Product. Everywhere, these costs are increasing exponentially, threatening the fiscal stability of programs and governments, and putting peoples' life savings at stake.

Therefore, Conference participants recommend that

governments encourage the use of economic and statistical analysis to estimate correlative relationships between risks generated from human exposure to toxic chemicals and the long-term health care costs that might be incurred.

A model for guidance lies in similar efforts in natural resource management. To justify adequate protection of coastal wetlands, advocates have found it necessary to quantify the economic value (in dollars) of these natural areas to preserve their resource value. The same kind of approach is going to be required for changes in management of health risks from toxic chemical exposure. The economic burden to future generations from physical and mental disorders associated with exposure to hazardous environmental chemicals needs to be quantified and projected.

There is also a universal need to develop better communications that relate to all obstacles, processes and remedies that bear on toxic substances in the Great Lakes Basin. Many elements in the communication process can hinder effective dialogue between the parties involved. These must be identified and overcome in order to develop effective inter- and intra-disciplinary communications among relevant and impacted parties that will raise the level of knowledge and understanding for all who participate.

Therefore Conference participants also recommend that

additional research be encouraged to identify the intervening factors between the scientific message and public perception and reaction.

THE NEXT STEP

The public needs reliable information about the utilization and consumption of resources from the Great Lakes Basin Ecosystem. The goal of this project is to clarify risks associated with the presence of Great Lakes toxic chemicals so that the public can make better-informed judgments, with a view to prevention of disease. By this effort we wish to provide knowledge that impacts on attitudes to change human behavior and thereby to reduce risks to health from exposure to these chemicals.

Judgments about public health risks from hazardous chemical exposure involve the acceptance of an inherent level of uncertainty. Scientists and governments have fallen short in publicly acknowledging this fact and, as a result, there have been significant confusion and misunderstanding by the public in formulating their own value judgments. Much of the human anguish associated with the issue of toxic chemicals in the Great Lakes Basin stems from the value judgments applied to questions of risk acceptance and the actual overestimation of the potential accuracy of risk assessment.

The toxic chemical issue strikes at the very core of our way of life. In a sense, it has placed us at a point where we view, on the one hand, the vital importance of protecting the quality of our environment, yet, on the other hand, wishing to retain modern conveniences and pleasures, some of which may be associated with the environmental degradation about which we are all concerned. We are beginning to perceive the dimensions of this dilemma and are offering policy approaches to achieving zero-discharge levels to toxins into the Great Lakes. Although we probably do not wish to acknowledge it, the public in general is annoyed by the simplistic explanations, edicts and superficial pronouncements offered to them thus far, as recently noted in a National Academy of Sciences report on Improving Risk Communication.

Therefore, as part of this continuing project, a PUBLIC PARTICIPATION CONFERENCE will take the scientific/technical results of the Fall 1989 International Working Conference and transform these recommendations into a public participation agenda. This Conference is planned for the late spring of 1990. Public input will be sought on citizens' concerns and perspectives on the issues that emerge from scientific discussion. The PUBLIC PARTICIPATION CONFERENCE will also provide a public forum for bringing forth those issues that may have been overlooked during the scientific/technical aspects of the project.

In addition to the above efforts at sharing the outcome of this project with the public, in the fall of 1990, to achieve a much wider public dissemination of scientific/technical findings, we propose using audio-visual teleconferencing as a means of conveying the information to the entire Great Lakes Basin public. Through this process we will attempt to capture and integrate the key components of the entire project in an effort to reduce confusion in the public on the subject of human risk and toxic chemical exposure in the Great Lakes Basin ecosystem.

The Great Lakes Basin represents a region of the world that incorporates the problems and complexities of international jurisdictions into a relatively confined and easy area for study. By examining the Great Lakes Basin Ecosystem with regards to environmental contamination and risks to human health, we can develop models for solutions to problems associated with toxic chemical exposure that can be applied in similar situations worldwide.

All who participated in the International Working Conference are listed in the following pages. Sponsors for this Conference included the State University of New York at Buffalo, the Canadian Department of National Health & Welfare, the U.S. Environmental Protection Agency, Environment Canada, the Centers for Disease Control (Atlanta, GA), the Canadian Department of Fisheries & Oceans, the Canadian Embassy (Washington, DC), DuPont, and CECOS International.

**EVALUATING RISKS TO HUMAN HEALTH ASSOCIATED WITH EXPOSURE TO
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**EVALUATING RISKS TO HUMAN HEALTH ASSOCIATED WITH EXPOSURE TO
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**EVALUATING RISKS TO HUMAN HEALTH ASSOCIATED WITH EXPOSURE TO
TOXIC CHEMICALS IN THE GREAT LAKES BASIN ECOSYSTEM**

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**EVALUATING RISKS TO HUMAN HEALTH ASSOCIATED WITH EXPOSURE TO
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EVALUATING RISKS TO HUMAN HEALTH ASSOCIATED WITH EXPOSURE TO TOXIC CHEMICALS IN THE GREAT LAKES BASIN ECOSYSTEM

EVALUATING RISKS TO HUMAN HEALTH ASSOCIATED WITH EXPOSURE TO TOXIC CHEMICALS IN THE GREAT LAKES BASIN ECOSYSTEM

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