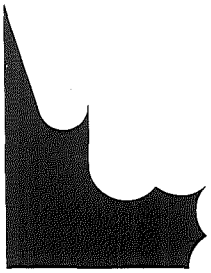

PROGRAM FOR ZERO DISCHARGE

A PROJECT OF THE

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Pollution Prevention in the Great Lakes:

The Need, the Current Status and Recommendations for Change

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PREFACE

This report is one of a series undertaken by the Canadian Institute for Environmental Law and Policy (CIELAP) in the context of the Program for Zero Discharge. The Program, which commenced in 1988, is a joint undertaking with the Great Lakes Natural Resource Center, National Wildlife Federation. The goal of the Program for Zero Discharge is to present the overall means by which the governments can transform the promise of the Great Lakes Water Quality Agreement into reality: a restored Great Lakes ecosystem, free from the harmful effects of persistent toxic substances.

To fulfil this aim, the Program is based on the notion the goal of zero discharge can by met by improving the implementation of the current regulatory system and, where weaknesses are identified, undertaking necessary reforms. To this end, the National Wildlife Federation has developed "model water quality standards" – standards which seek to implement the term of the Agreement and provide adequate protection for aquatic life, wildlife and humans. CIELAP has undertaken model technologies for two industrial sectors, petroleum refining and pulp and paper. Another study has reviewed the institutional implications of implementing the Agreement

The following report differs with the above studies somewhat since it reviews in detail the extent to which governments have undertaken pollution prevention initiatives as a means to achieve zero discharge. This review is followed by the development of a model pollution prevention law for each Great Lakes jurisdiction to adopt.

"The philosophy adopted for the control of inputs of persistent toxic substances shall be zero discharge"

Great Lakes Water Quality Agreement, Annex 12

INTRODUCTION

The presence of toxic chemicals in the Great Lakes Basin Ecosystem poses a formidable challenge to regulators charged with the responsibility to restore and maintain the integrity of the Ecosystem. Despite the fact that toxic chemicals have been recognized as the cause of environmental harm for well over two decades, Great Lakes jurisdictions have yet to develop a comprehensive and coordinated strategy to achieve integrity through the elimination of their discharges.

Several principles must govern such a zero discharge strategy if it is to be effective. The strategy must address all environmental media – air, water, land – and all sources – point and non–point – and it must be adopted by all basin jurisdictions. Only in this way can it be comprehensive. Most importantly, such a strategy must, to the extent possible, attempt to prevent toxic releases, rather than react to them after the fact, as is found in current environmental regulations.

Pollution prevention is an approach whose purpose is to prevent the creation, use and discharge of toxic substances. Pollution prevention as an approach to regulation is only beginning to be instituted, yet it may have enormous potential to solve many Great Lakes toxic problems. This report explores the concept of pollution prevention, reviews the extent to which it has been adopted by Great Lakes governments, and then proposes

a pollution prevention strategy for the Great Lakes.

The report is divided into three parts. Part I discusses the concept of pollution prevention: why the approach is needed, what the term encompasses, what barriers exist to its use, and what principles should guide its use as a regulatory strategy.

Part II describes the state of government programs using the pollution prevention approach generally in North America and Europe and then specifically in the twelve Great Lakes Basin jurisdictions. It concludes that, by and large, Great Lakes jurisdictions have yet to adopt the pollution prevention approach in their efforts to work toward the goal of zero discharge. Very recently, some jurisdictions have forged ahead with some innovative programs, but most of these programs are not integrated with existing programs and lack regulatory might.

To overcome the lack of a coordinated pollution prevention approach for the Great Lakes, Part III proposes a model pollution prevention law which, if implemented in every Great Lakes jurisdiction, would significantly advance the achievement of zero discharge.

I. THE NEED FOR A POLLUTION PREVENTION APPROACH

> How far have we progressed toward the goal of restoring the quality of the environment? The answer is in fact embarrassing. Apart from few notable exceptions, environmental quality has improved only slightly, and in some cases has become worse.
>
> Barry Commoner[1]

1. Why Pollution Prevention?

Nobody knows for sure the progress made in cleaning-up the Great Lakes. Certainly reductions of certain pollutants have been achieved and there are discernable improvements in many parts of the Great Lakes ecosystem. Despite these modest gains, however, there are indications that, despite two decades of regulatory effort and the expenditure of probably billions of dollars by both public and private interests, the Great Lakes are still under considerable unacceptable ecological stress. Why?

One important reason for this situation is that the focus of regulation is on the "control" of the release of pollutants rather than on seeking to "prevent" the use, generation and discharge of toxic substances. The "pollution control" approach has failed the Great Lakes. It has failed to protect the ecological and human health of the basin and thus has failed to achieve the goals of the Great Lakes Water Quality Agreement. It is also increasingly costly and inefficient. It is time to rethink this approach and develop a more preventative approach.

This chapter discusses the need for pollution prevention by emphasizing the evidence of the continuing toxic contamination of the Great Lakes, the obligations

undertaken by governments under the Great Lakes Water Quality Agreement, and the limitations of the pollution control approach.

1.1. The Great Lakes are Still in Trouble

While some progress has been made in reducing the levels of toxins in the Great Lakes, the ecosystem is still severely stressed. The improvements in levels have come for only a few chemicals and those improvements have slowed in the last few years. Current levels of toxic contamination in the ecosystem are unsafe for fish, wildlife and humans.

1.1.1. Ecological and Human Health Impacts

Fish and wildlife are sentinels sending out warnings about the effects of chemicals in the environment. Throughout the 1960s and 1970s, field observations revealed embryonic abnormalities and reproductive failures among a number of species of wildlife. While there have been substantial declines in concentrations in many categories of pollutants, most of these declines levelled off in the 1980s, with some highly toxic congeners even increasing in concentration.

A survey of the ecological problems in the Great Lakes was presented in the report, Great Lakes Great Legacy?.[2] It is clear that, despite declines in concentrations of toxic chemicals in water during the past two decades, ecosystem health problems arising from toxic exposure have not been resolved in the Great Lakes basin. The problems associated with fish and wildlife have important implications for human health. The lack of comprehensive human health studies prevents any definitive statement on

the extent of the problem. However, it can be stated that:

> * every jurisdiction now has advisories warning not to eat some fish and to limit consumption of others species of fish, with special advisories to sensitive populations, such as pregnant women. In 1989, a report revealed that some of these advisories may underestimate the risk of increased cancer by as much as 10 times.[3]
>
> * a number of studies have related maternal consumption of fish contaminated with PCBs and other chemicals to several health and behaviourial indicators in newborn babies, including lower birth weights, premature births, and certain other behaviourial defects;[4]
>
> * As one study noted, "nine of the IJC's critical pollutants have been associated with adverse effects in the human nervous system."[5]

What is clear is that little is known about the human health effects of toxic chemicals. There is evidence that many persistent toxic substances have been identified in human tissues, including ovarian follicles, testicles and sperm, placentae, amniotic fluid and breast milk. Human health impacts are difficult to understand due to a number of reasons:[6]

> * a lack of understanding of biochemical processes to identify cause–effect relationships between a chemical and an illness;
>
> * the time lags between chemical exposures and eventual identification of a problem;
>
> * multiple exposures from a chemical on a receptor; and
>
> * a lack of data on the long term impacts of low level exposure and on effects of a non–cancerous nature.

Despite these problems, the International Joint Commission has concluded that:

> When available data on fish, birds, reptiles and small mammals are considered along with this human research, the Commission must conclude that there is a threat to the health of our children emanating from our exposure to persistent toxic substances, even at very low ambient levels.[7]

In addition to the known impacts, it is important to recognize what is not yet known about toxic chemicals. There is a lack of knowledge about the synergistic, additive and antagonistic impacts of numerous substances found in the water and biota. The weight of research certainly indicates that chemical mixtures are more toxic than predicted from toxicity data on individual chemicals.

While there are ecological and human health impacts arising from persistent toxic chemicals, there are also other costs associated with this problem.

1.1.2. The Cost of Inaction

The presence of toxic contaminants in the Great Lakes ecosystem has also had serious economic consequences. For example, communities are forced to treat their water to make it safe to drink or fit to use in manufacturing processes. Canadian taxpayers are paying for a pipeline from Lake Huron to Walpole Island so that people will not have to drink water downstream from Canada's chemical valley in Sarnia, Ontario.

The costs to industry of trying to remove and treat pollutants before they are released into the environment are increasing rapidly. So are liability costs. These costs will continue to escalate as increased concern about contamination results in tougher regulations. More stringent regulations mean that it is becoming cheaper for industry to reduce their use of toxins rather than capture and treat them.

The costs of cleaning up the most severely contaminated parts of the Great Lakes are very high. For example, one group, the Washington, D.C. – based Northeast–Midwest Institute, estimated that it will cost between $2.9 billion and $3.4 billion dollars for a partial cleanup of only ten of the 42 areas designated by the International Joint

Commission as toxic hot spots. Similarly, the U.S. General Accounting Office estimated that it will cost at least $1.8 billion to clean up Michigan's Rouge River to public health standards by the year 2005. Government scientists from the Canada Centre for Inland Waters estimated that it will cost $6 billion over the next thirty years and $19 billion over the next one hundred years to contain, maintain, monitor and clean up four of the largest leaking dumps on the U.S. side of the Niagara River.

The health problems caused by chemical contamination are expensive for individuals and governments. The Province of Ontario already spends nearly one-third of its budget on health care, while in the U.S., almost one-tenth of the GNP is spent on health costs.

The virtual closing of the commercial fishery in many parts of the Great Lakes has had substantial economic impacts to individuals and fishing communities. These economic setbacks have resulted in part from prohibitions against selling fish contaminated by toxics.

Other parts of the economy that are affected by toxic contamination include food production, sports fishing and other recreational activities. The U.S. Fish and Wildlife Service estimated that anglers in the Great Lakes States spent over $28 billion on fishing and trip-related expenditures in 1985. This figure might be even higher if warnings about the safety of eating Great Lakes fish could be removed.

There are other subtle but significant costs from toxic contamination, such as:

* human potential may be decreased because of the effect of toxics on the development of this and future generations;

* ways of life are being destroyed for Native people who can no longer live in their

traditional ways; and

* the joy and inspiration that the Great Lakes bring are diminished.

1.2. The Obligation to Achieve Zero Discharge

In 1978, the national governments of Canada and the United States responded to the threats from toxic substances by concluding the Great Lakes Water Quality Agreement (GLWQA). The Agreement, both through its policy goals and its directives, mandates "zero discharge" of persistent toxic substances as the approach needed to deal with toxic chemicals entering the Great Lakes. This implies a preventive approach is necessary to achieve zero discharge.

1.2.1. The Basis of the Zero Discharge Goal

The GLWQA has its roots in a much earlier bilateral document, the Boundary Waters Treaty of 1909. That Treaty, among other provisions, established the International Joint Commission (IJC). In article IV, the governments promised that boundary waters, including the Great Lakes, "shall not be polluted on either side to the injury of health or property on the other."

One of the first references submitted to the IJC required the Commission to investigate and report on boundary water conditions both in the Great Lakes basin and elsewhere along the international boundary. In 1918, the Commission issued a report calling for urgent action, including the halting of all industrial discharges into the basin.

The zero discharge goal in the GLWQA owes much to the U.S. Clean Water Act of 1972. The objective of the Act was to restore and maintain the chemical, physical, and

biological integrity of the Nation's waters. To achieve this objective, the Act declared that "it is the national goal that the discharge of pollutants into navigable waters be eliminated by 1985". The zero discharge declaration in the U.S. water law was justified on a number of grounds, including the scientific uncertainties in attempting to determine "acceptable" ambient concentrations, the inherent difficulty and administrative burden for regulators in determining what levels of discharge were injurious, the disparity of standards among states, and the difficulty of enforcing ambient standards.

1.2.2. The GLWQA and Zero Discharge

(i) General

In 1978, the signatories of the Great Lakes Water Quality Agreement sent the unequivocal message that the discharge of persistent toxic substances would no longer be tolerated. It is clear that the Agreement was meant to prevent the further toxic contamination of the Lakes as well as to clean up existing contamination. The strength of the message sent out by the zero discharge commitment must be seen in light of the relatively little information which was available on the true adverse impacts of persistent toxic chemicals.

Article II of the Agreement sets out the purpose of the Agreement, which can be seen as a hierarchy of obligations. The first paragraph establishes the commitment to "eliminate or reduce to the maximum extent practicable" the discharge of all pollutants.

The second paragraph mandates a special, more stringent, commitment pertaining to toxic substances, namely, that the discharge of toxic substances in toxic amounts shall be prohibited, and that the discharge of all persistent toxic substances to the Great Lakes

ecosystem shall be "virtually eliminated". The qualifying words, "to the extent practicable", found in the general commitment to reduce all discharges, not present in the obligations pertaining to the elimination of toxic discharges. Annex 12 of the GLWQA specifies how persistent toxic substances are to be regulated. It mandates that regulatory programs and strategies be adopted in the philosophy of zero discharge. Thus, it can be said that the commitments to eliminate the discharge of persistent toxic substances should be pursued in a much more diligent way than for other pollutants.

In 1987 the GLWQA was renewed with the clear intention that the virtual elimination goal was to be the ultimate goal. Many provisions of the Agreement were deemed "interim", pending the achievement of virtual elimination, including the Specific Objectives. In addition, the inclusion of Annexes 13 (pollution from non-point sources), 14 (contaminated sediments), 15 (airborne toxic substances), 16 (pollution from contaminated groundwaters) and the call for the reduction in the generation of contaminants in Annex 12 are among the provisions in the 1987 Protocol which suggest that the virtual elimination goal refers to more than simply direct discharges. Instead, there is a clear intention that the Agreement applies to all inputs, direct or otherwise, and to all environmental media.

(ii) Other Support for Zero Discharge

While the GLWQA was concluded by the national governments, the provinces and states have also agreed to abide by its provisions. The Great Lakes Toxic Substances Control Agreement, signed in May of 1986 by the eight Great Lakes states and agreed to by Ontario and Quebec in 1988, commits the signatories to actions consistent with the

Great Lakes Water Quality Agreement. Principle IV of that Agreement commits the states and provinces to the goals and obligations of the Great Lakes Water Quality Agreement.

In addition, section 118 of the 1987 amendments to the U.S. Clean Water Act states that the U.S. should "seek to attain the goals embodied in the Great Lakes Water Quality Agreement of 1978 with particular emphasis on goals related to toxic substances."

(iii) What is Meant by Zero Discharge?

When the various provisions of the Agreement are put together, the definitional parameters of zero discharge can be identified. Zero discharge can be defined as the elimination of all inputs of persistent chemicals, whether from direct discharges into waterways or air, indirect discharges such as agricultural and urban run–off, and inadvertent discharges, such as those from leaking landfills or from reactivation of contaminated sediments. The guiding assumption behind this definition is that all sources of persistent toxic chemicals must be eliminated so that there will be no opportunity for the substances to enter the ecosystem. In short, zero discharge, as a regulatory strategy, requires both eliminating inputs and cleaning up existing problem areas.

1.3. The Limitations of the Pollution Control Approach

A zero discharge strategy means going beyond the existing approach to regulation. The existing "pollution control" approach has a number of serious limitations when used with respect to toxic pollutants that hamper its ability to achieve significant improvement in environmental health. In the United States, the chemical industry has dramatically increased production in 40 years from 20 to over 220 billion pounds a year. Some 70,000

chemicals are now in commercial use with 500 to 1000 new chemicals added every year. According to the U.S. 1987 Toxics Release Inventory, at least 22 billion pounds of toxic substances are released into the environment every year.[8] (With a lack of data, no comparable statistics are available for Canada, although it can be presumed the discharges levels would be similar on a per capita basis.)

What these estimates confirm is that despite 20 years of environmental regulation and billions of dollars spent on compliance with those regulations, very large quantities of toxic substances continue to enter the environment every year. Regulatory agencies have attempted to "control" pollution to some "safe" level, rather than attempting to "prevent" the use, generation or discharge of pollutants in the first place. The weaknesses of this control approach can be linked to its "end–of–pipe" emphasis, its media–specific bias, its fragmentation of effort, its economic inefficiency and its data gaps in loadings and sources.

1.3.1. The End–of–the–Pipe Focus

Environmental laws usually only regulate the concentrations of contaminants that can be discharged into the environment. That is, there are no prohibitions on the creation of pollutants or wastes, only on their discharge in certain concentrations. The effect of these laws and regulations has been to promote the use of pollutant collection and treatment systems at the "end–of–the–pipe" and the disposal of collected wastes into other media. In addition, regulations tend to focus only on direct point–source discharges, not on "non–point" sources such as agricultural and urban run–off. Such sources are considered responsible for perhaps 50% of water pollution in some

watersheds. Thus, significant amounts of waste containing toxic constituents continue to be released into the air, land, and water, despite stricter pollution controls and skyrocketing waste management costs.[9]

In the U.S. and Canada, the laws are focused on end-of-the-pipe technology. For water discharges, technology-based standards often mandate treatment systems for pollutant removal as the "best available control technology" (BAT). Industries are required only to achieve the performance standards based upon the BAT designed limits, even though some industries could make substantial improvements. Rather than assessing the potential in-plant modifications to reduce overall pollutant loadings, industries often "respond by simply plugging pollution control technologies at the end of their production lines to capture and remove enough of the regulated toxic substances from their waste streams to come into compliance with regulatory limits."[10] The end-of-the-pipe approach, therefore, implicitly sanctions and legitimizes the generation of these pollutants and wastes. Once generated, this approach encourages the transfer of pollutants to treatment and disposal systems, for example, the burning or landfilling of sludges. It does not necessarily force the adoption of new technologies to reduce the amount of toxic substances requiring collection, treatment or disposal.

1.3.2. Medium Specificity

Another limitation of the pollution control approach is that nearly all existing programs focus on one environmental medium --air, water or land -- and control the pollutants that enter each directly from industrial processes. This medium specific approach has a number of problems:

(a) medium specific laws result in the transfer of pollutants from one medium to another rather than work toward the elimination of the pollutants;[11]

Many environmental laws, rather than limiting the amount of pollutants entering the environment as a whole, may only effect a change in their place or rate of entry into the environment. For example, more stringent air pollution standards for toxic particulates may require the use of electrostatic precipitators or baghouses that remove particles from the exhaust gases. These particles can be heavily concentrated with toxic substances and must then be disposed of. When disposed of in a landfill, there is the potential for the contaminants to leach out and contaminate the soil and groundwater, eventually reaching surface water.

(b) single medium laws do not take into account the cycling of pollutants through the environment.

Even if pollutants are not directly shifted to another medium, they will move through different media by natural processes. This "cycling" occurs when air pollutants are deposited to water or land, when erosion releases particles into ground or surface water, and when chemicals in water or land volatilize into the air. Because traditional programs do not take account of these processes and the chemical changes that can occur during them, such as the formation of acid rain or methylation of mercury, standards may underestimate the risk to the ultimate receptor.[12]

(c) medium specific laws ignore multiple exposure routes on a particular receptor.

Medium specific laws may underestimate the risk on a receptor because, when ambient standards are developed to protect a particular receptor, it is assumed that the receptor will only be exposed to the chemical through that single medium. Many air

quality standards, for example, are developed on the basis of the effects from inhalation of that pollutant without assuming that the average person will be exposed to the same pollutant when eating contaminated fish or when drinking water.

1.3.3. Fragmentation of Effort

Since its inception, the pollution control approach has been applied in a fragmented manner. Water, air and waste laws are administered by separate branches or agencies, without coordination or communication. This fragmented approach resulted from the incremental evolution of environmental laws. It has been estimated that, at the federal level in the U.S., there are 25 separate laws administered by 10 agencies to address toxic substances and wastes.[13] The standards and permits issued under these acts are not coordinated so as to achieve a minimization of risk from all sources of a substance.[14] Similarly, in Canada, under some 30 federal statutes, 24 departments have responsibility over different aspects of toxic and hazardous substance control.[15] This situation is further exacerbated when the myriad of state/provincial laws are added.

Not only is there fragmentation in setting the standards, but also in implementing them through the permit system. Medium specific legislation usually requires separate permits or approvals for discharges of contaminants to each part of the environment, even for a single plant. As one study noted, "With few exceptions, present statutory schemes for granting permits are implemented under separate laws and rarely at the same time so that the impact of releases into the environment are rarely evaluated simultaneously."[16] For example, for a primary metal processor, at least one permit would be needed to release contaminants into the air during smelting, another to

discharge the process water, and yet another to bury the residues in the landfill. Each permit would be processed independently by different branches of one agency or perhaps even by different departments, usually without notification to branches responsible for other media. A similar situation occurs in Canada.

This fragmentation of effort occurs both within a given jurisdiction and between different jurisdictions sharing the same natural resources, like the Great Lakes. For instance, within the Great Lakes ecosystem, there remains a remarkable incredible degree of fragmentation. Fish advisories between the jurisdictions often differ even with respect to the same body of water; there is little coordination with respect to permitting; standard-setting processes vary considerably resulting in different standards for the same chemicals in neighbouring jurisdictions; and there are incomplete and inconsistent data bases and a lack of integration of research efforts.

1.3.4. Data Gaps in Loading and Sources

Another limitation of the existing approach relates to data. There are major gaps in understanding all the sources of toxic pollutants and their relative contributions in the Great Lakes. While this situation is gradually improving, especially with such mechanisms as the U.S. Toxic Release Inventory, there is little effort in the Great Lakes basin to coordinate that data in a basin-wide fashion, and integrate it with Canadian data, once it becomes available.

Also, there is a serious lack of data about the fate of pollutants and wastes that are generated and used by industry. Without a complete picture, standards cannot be set and no mechanism exists for ensuring that compliance with the few existing standards

is occurring. In the U.S., with a requirement that large industries report on the fate of 328 chemicals, the estimate for 1985 is that 22 billion pounds of these chemicals are released into the environment every year.[17] In Canada, without mandatory reporting, the government's understanding of compliance with its regulations is poor.

1.3.5. Economic Inefficiency

A final limitation of the traditional approach is its economic inefficiency. It has been estimated that $70 billion is spent annually by U.S. regulators and industry on compliance with environmental regulations.[18] This substantial investment by industry has been used primarily for remedial end–of–the–pipe technology which captures part of a waste stream; it is not being put into productive capacity. There are also increasing costs associated with increased private liability for spills and waste sites. Finally, generally speaking, more stringent regulations mean that more and more money is spent to achieve smaller increments of pollution control.

The large costs paid by North American industry are much greater than the amounts that are invested in pollution control in competing economies in Europe and Japan, where regulatory standards are similar. It has been suggested that the reason for this is

> "not merely greater government regulation but <u>less flexible</u> environmental regulations in the United States that block effective and more economical and technologically advanced solutions."[19]

This added factor can put U.S. and Canadian industry in a competitively disadvantageous position with respect to their trading partners.

Summary

Several factors motivate increasing interest in pollution prevention. These include:

* a recognition of the serious risks posed by the continued entry of toxic substances into the environment;

* limitations on existing regulatory programs to effectively minimize risk;

* increasing compliance costs for both regulators and regulated industry;

* expanding liabilities for polluters; and

* increasing production costs.

These factors motivate use of pollution prevention because prevention is seen as providing an approach that maximizes both economic and environmental benefits.

2. Toward Zero Discharge: From Pollution Control to Pollution Prevention

The pollution control approach is not working to eliminate the harmful effects of toxic substances. The Great Lakes are still under ecological stress, despite two decades of investments and efforts to "control" pollutants. In order to achieve the GLWQA goal of zero discharge, it is necessary to translate that goal into a concrete regulatory strategy that will overcome the limitations of the existing approach. There should be two elements of a Zero Discharge Strategy: prevention of further discharges and clean up of in-place contamination. Although this report focuses on the former, it should be emphasized that both are needed in order to restore the ecosystem to health.

This section examines the nature of pollution prevention as an alternative approach

to environmental legislation. Its nature, definition, benefits and barriers to its implementation are discussed.

2.1. What is Pollution Prevention?

Pollution prevention is an approach that seeks to address the problem of toxic pollution by attempting to avoid the use, creation and disposal of the contaminants in the first place. It attempts to address all sources of pollution, both point and non–point source pollution, direct emissions to water, air and wastes from industrial processes, fugitive emissions and residues, as well as the use and disposal of toxic products.

Pollution prevention is usually contrasted with the predominant regulatory approach, which seeks to "manage" or "control" the release of pollutants into different parts of the environment and "manage" the disposal of wastes. Pollution prevention, on the other hand, attempts to eliminate or minimize, to the extent possible, the amount and toxicity of chemicals used in different processes and the amount and toxicity of resulting by–products. The purposes of the preventive approach are to achieve less toxic pollution that must then be managed and to lessen associated risk to workers, consumers and the environment. It also seeks to conserve resources that would otherwise be wasted.

How does one achieve pollution prevention? Instead of concentrating on "end–of–the–pipe" pollution control equipment and waste disposal options, pollution prevention techniques centre on materials and processes that contribute to pollution. These techniques are intended to substitute non–toxic or less toxic substances for toxic ones and to modify processes that create toxic by–products. Specifically, such techniques include:

(1) *material modification or substitution*; for example, the replacement of lead or mercury in paint with less toxic constituents or the substitution of water–based inks for solvent–based ones;

(2) *end product redesign or substitution*; for example, the redesign of coolants that use chemicals other than chlorofluorocarbons;

(3) *process modifications*; for example the replacement of chemical processes (such as the use of organic solvents or acid treatment) with mechanical processes;[20]

(4) *use of closed loop processes* or in–process recycling;

(5) *good operating practices* such as the use of more efficient equipment, preventive maintenance, employee training and good housekeeping to ensure optimal process conditions and minimal leakage from a process; and

(6) in *end uses*, substitution of toxic products with non–toxic products, such as in pest control in forestry or agriculture.

Obviously, these different techniques present widely differing financial and technical challenges to industry and governments. The extent to which these challenges are barriers to the adoption of these techniques is discussed below.

There are many different terms which are used to mean pollution prevention or related concepts. Many of these terms are used in different ways by different agencies or groups, which can be confusing. Some of these terms are:

(1) "Toxics Use Reduction" – This refers to changes in the production processes, products or raw materials that reduce, avoid, or eliminate the use of toxic or hazardous substances per unit of production so as to reduce overall risks to the human health and the environment without transferring those risks to other people or parts of the environment. If targets are set for achieving reduction goals, it means the same as what is meant by pollution prevention in this paper.[21]

(2) "Source Reduction" – This usually means the use of prevention techniques but principally those associated with industrial sources of toxic substances only.

(3) "Waste Reduction" – This is usually used to mean substantial reduction in the volume or toxicity of waste that is disposed of. This approach thus deals with wastes already created and emphasizes diversion from disposal by landfilling or incineration through recycling or treatment as well as prevention. An important exception to this is the Office of Technology Assessment, whose seminal work on pollution prevention used the term waste reduction.[22]

(4) "Non– or Low–Waste Technology/ Clean Technology" – focuses on industrial manufacturing techniques that minimize the use of raw materials and energy while minimizing the amount of waste created. It usually includes recycling and recovery techniques.[23]

(5) "Clean Production" – has been defined as the "conceptual and procedural approach to production that demands that all phases of the life–cycle of a product or of a process should be addressed with the objective of prevention or the minimization of short and long–term risks to humans and to the environment."[24]

2.2 The Benefits of Pollution Prevention

In coming to grips with toxic problems, pollution prevention attempts to overcome many of the limitations of existing programs and to get closer to the goal of environmental health while keeping industry competitive. Prevention is more likely to directly benefit industry in the broader context of industrial efficiency and technological change.

The Environmental Benefits – Reduced Exposure

Environmentally, the degree of risk and opportunities for exposure, both within a plant and in the environment generally, are substantially reduced. The promise of pollution prevention for the environment is potentially enormous, although it is difficult to gauge this potential with certainty. One estimate of this potential states that one–quarter to one–third of hazardous wastes generated could be avoided within five years, with the widespread use of existing and well–known techniques.[25] Another estimate states that

existing techniques could eliminate 30 to 80% of hazardous wastes now entering landfills.[26]

It is difficult to make accurate estimates of this potential because of the uncertainty that exists about the volumes of wastes and pollutants now generated. There is also uncertainty because of different definitions of toxic or hazardous pollutants or waste and the lack of an accurate data base, particularly in Canada.

Furthermore, predicting the future potential of prevention is uncertain because toxic generation data are too aggregated over processes, plants and companies to prove or disprove that any given degree of pollution prevention is taking place. The volumes of pollutants generated vary over time with changes in industrial activity, product mix, environmental regulations and waste treatment techniques. Thus, reduction could occur as a result of a number of factors. However, it is clear that enormous amounts of toxic chemicals and waste products are now generated that create environmental risk, and that pollution prevention could significantly reduce those amounts and their associated risks.

The Economic Benefits – Efficiency

Pollution prevention is thought by most writers to be an economically efficient as well as an environmentally beneficial approach.[27] Some of the benefits include:

* resource and energy use are reduced with increased productivity;
* costs for waste management and pollution control equipment will be substantially reduced; and
* potential liability for harm caused by exposure to toxic chemicals, transportation, storage, and disposal of hazardous wastes will be reduced.

One of the most extensive case studies on the economic benefits of clean technologies was in France. Of the 600 clean technology applications examined, a

number of benefits were identified in terms of savings in raw materials, energy use, and improvements in working conditions. The analysis showed that 67 per cent of the applications enable savings in raw materials, 26 per cent in waste utilization, 21 per cent in accident risk reduction and 20 per cent in improved working conditions.[28]

Apart from reduced environmental exposure and economic efficiency, there are also other benefits with pollution prevention. For example, compliance with regulations would be more easily achieved. Many companies have also found that there are public relations benefits for adopting a pollution prevention approach.

2.3 Barriers to Pollution Prevention

The importance and potential of pollution prevention are recognized in principle by governments, industry and environmentalists, but significant barriers to effective implementation exist which limit reliance on it as a preferred approach to regulatory toxic chemicals. Most governments assume that prevention will result from more stringent environmental regulations and do little to remove the barriers that prevent this from occurring. The nature of these barriers are addressed below.

2.3.1 Information

Most studies on pollution prevention identify lack of information as a central obstacle to its implementation. Awareness that reduction is feasible and financially beneficial, and information about techniques that could prevent the generation of contaminants are lacking for many toxic generators. This lack of information is particularly acute for small companies that have no in-house research and development expertise. Many companies are reluctant to change from familiar, widely available

technologies to new processes with apparently uncertain benefits. The attitude of the toxic user is a major barrier to pollution prevention.

Another information–type problem is that many companies who have successfully reduced waste or toxic generation are reluctant to communicate the secrets of their success to their competitors. This reluctance is based on the advantage they gain from their prevention efforts.[29] The lack of communication, and resulting failure to transfer knowledge concerning clean production, has delayed or prevented many companies from considering and implementing pollution prevention methods.

By and large, engineering course curricula and training schools still preach pollution control, not pollution prevention. All disciplines, from engineering to law, will have to integrate this thinking to train people better in the implementation of pollution prevention.

2.3.2 Technology

One of the obvious barriers is that the development of pollution prevention and clean production technologies has not been given regulatory priority, and as such, there is a lack of clean technologies available for general application.

Generally, companies go through three phases of prevention.[30] In the initial phase, firms invest in low–cost options, such as minor process changes and good housekeeping practices. After exhausting their low–cost options, firms will increase their level of expenditure and technical sophistication by adopting capital–intensive technologies. This second phase tends to focus on recycling or reuse of waste streams, on product changes, or on–site waste treatment. After exhausting these possibilities,

firms will only then turn to the research, development and demonstration phase. In this phase, as yet unproven alternatives to available technologies are investigated and demonstrated. Many firms lack the funds (or the ability to generate funds) or the expertise to go beyond the initial phase.

Another barrier is that pollution prevention measures may require production process changes which may be seen as a threat to product quality, unlike end–of–the–pipe technologies which are removed from the core production process.[31]

2.3.3 Institutional Inertia

One of the barriers which is often underestimated is simply the hesitancy of industries, governmental agencies, and other private and public interests to do something different, even if the benefits can be justified. The Office of Technology Assessment noted:

> The major obstacles to increased waste reduction are institutional and behavioral rather than technical. Economic considerations are not an intrinsic impediment to waste reduction; rather, there are hurdles or barriers to overcome before short–and long–term economic benefits can be realized by waste generators.[32]

There is no magic response to overcome the problem of inertia. However, education and public awareness programs certainly can be considered as a starting point to present a compelling and coherent argument for change.

2.3.4 Regulatory Problems

The regulatory requirements of existing pollution control and waste management programs also influence movement to pollution prevention. To operate legally, firms must meet specific standards for contaminants. Both government and industry are much more

familiar with pollution control and waste management techniques than with techniques to reduce contaminant generation.

At present, more than 99% of environmental regulatory budgets go toward controlling pollutants after they have been generated. In addition, regulatory programs are "mostly driven by available, proven control technology rather than by health and environmental considerations," allowing a certain amount of pollution into the environment and creating no incentive to do more than meet today's standard.

In many cases, the existing regulatory system has curbed innovation both because of its cost and its complexity. For example, one commentator suggests that, while it may be thought that the costs associated with obtaining a permit would be an incentive to pollution prevention, "it appears that in practice because production process modification requires re-certification, which can take up to a year;" the anticipation of having to go through a permitting process reinforces the status quo and acts as an impediment to change.[33] Innovation is seldom accommodated in the existing rigid regulatory system.

Overall, little effort has been devoted to incorporating pollution prevention in existing regulatory frameworks and supplementing that framework with useful and effective pollution prevention requirements.

Other regulatory barriers have been identified, including inconsistent exemptions from regulations (such as small quantity exemptions), inconsistent enforcement, overlapping jurisdictions, the small number of standards for toxic substances, and the combination of inadequate standards for disposal, and overly strong standards for prevention and recycling. Moreover, the medium specific approach of the current

regulatory approach often skews the picture of the overall environmental exposure of a facility, making prevention appear less needed.

2.3.5. Financial Considerations

Companies often have substantial investments in existing process and pollution control equipment and a corresponding interest in ensuring that those investments are not wasted. Because of differences in age, lay–out, equipment, raw materials and process volumes, individual plants vary greatly in the potential cost and effectiveness of prevention efforts.

Furthermore, government financial incentives such as tax breaks or research subsidies are skewed in favour of pollution control technologies. The current pricing of waste disposal and treatment also discourages the adoption of prevention. Tipping fees at landfills, treatment facilities and transfer stations are still often low enough that creation and disposal of toxic wastes remain the preferred option. Because such low fees do not reflect the long–term costs of waste disposal, they operate as a disincentive to development and adoption of pollution prevention techniques.

It has also been argued that U.S. tax laws do not have an environmental focus,[34] and the same can be said of Canadian tax laws. As such, there is no preference or taxation benefit for pollution prevention measures over pollution control investments. There is a question, for instance, if the redesigning of a product to reduce emissions would have the same accelerated depreciation as a capital expenditure on pollution control equipment.

One author referred to the problem of "pollution prevention" inertia in the

market.[35] For instance, the economic benefits of pollution prevention are difficult to ascertain with any degree of certainty. Accordingly,

> The actual waste management costs, potential hazardous waste liability costs, and compliance and oversight costs are not at present routinely itemized in an accounting system... Within industry, these costs are often carried as corporate overhead expenses not charged back to production lines. Consequently, production managers have little incentive to reduce these costs.[36]

This uncertainty in predicting benefits of investing in prevention, and the often substantial investment in pollution control equipment, contribute to the resistance of companies to change. Some work would be needed to convince corporate managers that the initial capital investment in pollution prevention measures will have a larger pay-back in the long-term with lower operating costs.[37]

Because of the combined effect of these numerous barriers, pollution prevention will be difficult to achieve until they are removed. For this reason, the prevention strategy set out in Part III includes some specific measures to try to overcome these barriers and provide a positive atmosphere for the adoption of a pollution prevention strategy.

Mentioned but not available:

Table 1	Summary of Pollution Prevention Initiatives in the Great Lakes
Table 2	EPA Funded Pollution Prevention Programs in the Great Lakes
Appendix	Jurisdiction-by-Jurisdiction Review of Pollution Prevention Initiatives in the Great Lakes
Appendix	Copy of Pollution Prevention Survey

II. GOVERNMENT ACTION ON POLLUTION PREVENTION

Overview

In the last chapter, pollution prevention was discussed as a necessary approach to deal with the contamination of the Great Lakes. This chapter examines recent governmental initiatives employing the pollution prevention approach. In order to illustrate the range of approaches that have been adopted, a number of initiatives from both Europe and North America are examined. The following sections then focus on initiatives adopted by the jurisdictions in the Great Lakes. During the summer of 1989, a survey was forwarded to Great Lakes environmental agencies for the purposes of gathering information about pollution prevention initiatives in each jurisdiction. Follow-up contacts were made subsequent to the survey.

When reviewing the record on government action on pollution prevention, the results are certainly mixed, especially in the Great Lakes Basin. The primary findings of the study can be summarized as follows:

(1) Within the western world, there is a discernable movement toward a pollution prevention approach to regulation. The approach differs significantly in different jurisdictions, ranging from voluntary to some mandatory regulations (such as a procedure to phase-out certain categories of chemicals).

(2) Great Lakes jurisdictions are not the leaders in designing pollution prevention initiatives, despite the strong policy impetus to move toward pollution prevention strategies to achieve zero discharge.

(3) Further, there is little institutional leadership in the Great Lakes for pollution

prevention. Until recently, neither the International Joint Commission nor the national governments have comprehensively addressed strategies for implementing the goal of zero discharge in a serious or a comprehensive way. Because of this hesitancy, much of the long-term research, technological and regulatory changes have not yet been undertaken.

(4) Of those initiatives which are being undertaken in the Great Lakes, most still focus on "waste management", for example, promoting diversion of toxic waste from disposal in landfills. This "waste management" approach has tended to disaggregate water and air emissions from hazardous wastes. Non-point source initiatives are virtually ignored.

(5) Finally, even though the term "pollution prevention" has gained some momentum, the concept has yet to be integrated into regulatory, financial, educational and other policies of most jurisdictions. "Pollution prevention" remains an "add-on" to the usual environmental protection business.

1.0 The Emerging Movement to Pollution Prevention

When reviewing the recognition and acceptance of pollution prevention in other countries and in North American jurisdictions outside of the Great Lakes basin, it is apparent that pollution prevention is not a new concept. Indeed, a number of countries have already taken some innovative steps to promote a preventive approach. This section describes some examples of these steps: the Clean Technology Policies of the European Community and the Netherlands; the proposal before the Organisation for

Economic Cooperation and Development (OECD) concerning sunset chemicals; technical assistance programs related to pollution prevention, and toxic use reduction laws in a number of U.S. states.

This review of pollution prevention initiatives outside of the jurisdictions of the Great Lakes does not purport to be comprehensive. Instead, it is meant to be illustrative of the kinds of models being used to eliminate or drastically reduce the discharge of toxic chemicals.

1.1 Clean Technology Policies

One of the first coherent efforts to establish a preventive elimination strategy for pollutants was the adoption of "clean technology" policies.[38] Clean technology policies are intended to encourage technological innovation for the purposes of either preventing the creation of pollutants or reducing to the maximum extent possible the discharge of pollutants whose creation cannot be avoided. By and large, these innovations address in-process changes, rather than end-of-the-pipe add-on technologies, and include closed-loop technologies, process changes, and product reformulation.

Japan and many European countries such as Denmark, Finland, France, West Germany, Sweden and the Netherlands, have active and mature clean technologies policies.[39] Many of these countries have created specialized bodies to deal with clean technologies. These bodies or agencies provide financial and technical assistance, research monies and information services. Two examples of clean technology policies are discussed below.

1.1.1 The European Community

For well over a decade, the Commission of the European Community (EC) has recognized the need for a preventive approach to environmental protection.[40] The basis of the clean technology policy can be traced to the Council meeting in April of 1970 where the term was defined.[41] Early work with respect to this policy included a series of sector specific industries for the purposes of information-gathering. Some of these industries included pulp and paper, agri-food, tanning and chemicals.

This approach is demonstrated in two important instruments. First, under the Single European Act of 1986,[42] the EC established the basic principles of its future environmental policy. The Act states that action by the Community relating to the environment shall be based on the following principles:

(1) pollution prevention is the preferred environmental protection approach;

(2) pollution must be controlled at the source;

(3) the polluter must pay for the costs of control; and

(4) environmental requirements and considerations must be integrated into other EC policies.

Second, the EC's 1983 and 1987 Action Programmes on the Environment formed the basis for an overall preventive strategy for environmental protection. The thrust of these programs is the development of systematic low-waste and clean technology policies as preventive alternatives to traditional pollution abatement methods.

The 1984 and 1987 Council Regulations on Actions by the Community relating to the Environment (ACE)[43] have provided over $10 million (U.S.) for demonstration projects on clean technologies. The demonstration projects are directed at the development and implementation of innovative technologies, such as those that have yet

to be tested at the full-scale level. These funds are intended to sponsor up to 30% of the project, and as of 1989, over three dozen projects had received support from the funding provided in these regulations.

In addition to these measures, the Community has established the NETT (Network for Environmental Technology Transfer) database through which members can obtain access to technical and market information relating to clean technologies. NETT was set up as an outcome of the Community's Fourth Environmental Action Programme (1987-1992) and the European Year of the Environment (1987-1988). The program is based on the assumption that there is a need to provide a system for the exchange of information and for the transfer of clean technologies, cost-effective pollution abatement methods and waste treatment technologies.

The EC's clean technology policy takes a "soft" regulatory approach to pollution prevention, relying on financial incentives and the removal of technical and informational barriers to achieve its goals. This approach has met with some success. The EC's policy is also important because it transcends the bounds of environmental protection and is integrated into the long-term industrial strategy for the Community.

1.1.2 The Netherlands

In 1989, the Netherlands initiated its National Environmental Plan (NEP)[44], a comprehensive plan that is to act as an environmental strategy for the country into the next century. One of the important features of this plan is the adoption of targets for emission reductions of 70 to 90% by 2010 for 29 priority pollutants. The Plan emphasizes pollution prevention in a number of ways, including:

* providing instruments for promotion of clean technologies and clean production;

* building public awareness for the pollution prevention concept; and

* subsidizing pilot projects for clean technologies.

To promote clean technologies, the Netherlands initiated the Department of Environmental Technologies, formally the Clean Technologies Department. Innovation Centers were also established, although the mandate of these centers is far broader than environmental technologies. As part of the Innovation Directed Research Programmes, a research and development program is dedicated to clean technology. Of the financial incentives for environmental technologies, approximately 28% is directed to clean technologies. There are also other financial incentives available.

The clean technology program in the Netherlands also called for the adjustment of regulations. According to one case study, the Netherland's policy is to modify regulations "in order to achieve better coordination, faster permitting procedures and a heavier emphasis upon results instead of imposing predetermined technical solutions."[45] For example, an attempt is being made toward integrated permitting and emission reduction agreements, known as "covenants," between industry and government.

In sum, clean technology policies can be viewed as a step toward pollution prevention. They attempt to overcome many of the barriers to prevention and thereby encourage the adoption of clean technologies. They can be supplemented by a host of initiatives, such as those discussed in the next section.

Pollution prevention programs have their roots in state waste minimization efforts and most states now have a waste reduction program in place. While in 1981, there were

only two states that had waste minimization programs, by 1989, there were some 36 programs in place, with an additional six programs conducted by universities and private organizations.[46] on–site assistance, workshops, and information clearinghouses); educational programs (including pamphlets, conferences, and award programs); economic incentives (such as tax breaks, fees, grants and loans) disincentives for disposal; waste exchange programs, research and development activities; or regulatory requirements (such as mandating waste reduction targets for industry).[47]

While "waste reduction" efforts have been a first step toward pollution prevention, they have a number of weaknesses. The most obvious is that they are medium specific in that they seek to reduce disposal of hazardous waste, without recognizing the effects on air and water. Second, they tend to emphasize the "management" of waste rather than its prevention. That is, they are directed at reducing the toxicity or amounts of waste going to landfill by promoting recycling, reuse and treatment as well as prevention. Third, they tend to be very modest programs in relation to overall environmental financial and personnel resources. According to one study, the waste minimization programs range in cost from $60,000 to $2 million a year. The average cost, however, is approximately $150,000 and involves one to two staff persons.[48] Finally, they seldom are mandatory. By far the most common component of state programs is technical assistance.[49] Thus, the emphasis is on encouraging the voluntary adoption of appropriate techniques. There are no penalties for not taking such an approach and, as discussed below, federal law does not require waste minimization planning.

The transition from waste management to pollution prevention has, however,

commenced in a number of states.[50] Increasingly, programs have a legislative basis. Many state programs also include tax incentives for adopting prevention technology and a technical assistance package which varies from jurisdiction to jurisdiction.[51]

1.2.2 North Carolina

One of the first programs to move beyond waste reduction to pollution prevention is in North Carolina. The North Carolina Pollution Prevention Program is one of the longest standing and most comprehensive of the state programs. It is also illustrative of many other state programs, which have adopted some of its elements. The North Carolina program began in the early 1980s as a non-regulatory effort directed at finding alternatives to landfill disposal of hazardous wastes. It has evolved into a legislatively mandated, multi-media prevention program designed to reduce the generation of hazardous wastes and air and water pollution and the use of toxic materials.[52]

The purpose of the North Carolina program is to encourage voluntary prevention efforts. To accomplish this, the government provides three major services: technical assistance, research and education support, and financial assistance. Specific services include an information clearinghouse for literature, reports, case studies and contacts, on-site technical assistance to develop plant-specific waste reduction options, information packages for industry, public and industrial outreach, matching grants to industry for demonstration projects, grants to universities for research and development projects, workshops, manuals and factsheets. North Carolina also administers a federally-funded project to track and evaluate multi-media releases and prevention efforts.[53]

1.2.3 Evaluation

Technical assistance programs have been moderately successful in encouraging the adoption of waste reduction and pollution prevention techniques. However, because of severe limitations on available data, it is almost impossible to be precise about the amount of waste or pollution reduced as a result of such programs.

1.3 Toxic Use Reduction

Recently, a new approach to pollution prevention has emerged which goes beyond the voluntary programs. It is now known in many states generally as "toxic use reduction" laws. In addition to setting state-wide reduction targets, such laws require industries using or generating toxic chemicals to: conduct audits or inventories of toxic chemicals used or generated; draw up a plan for how they will reduce their use or generation of toxic substances; and have the plan certified by specialized toxic use reduction planners. Other components may include new institutions, such as Offices of Pollution Prevention or Institutes of Pollution Prevention, toxic use fees, and citizen involvement and enforcement.

For the purposes of review and comparison, the toxic use reduction laws in Massachusetts, Oregon and Texas will be briefly reviewed below. Other U.S. states, such as Maine and Washington[54], also have such laws in place.

As discussed in section 2, a number of Great Lakes jurisdictions are also proposing or have passed toxic use reduction laws, which are discussed in a later section.

1.3.1 Massachusetts

The Massachusetts Toxics Use Reduction Act was passed in July of 1989. In it,

the state established the goal of achieving 50% reduction in 1987 quantities of toxics generated by industry by 1997. To achieve this goal, the act focuses on "toxics use reduction" techniques including input substitution, product reformulation, production unit redesign, modification or modernization, improved operation and maintenance of equipment or methods such as good housekeeping, system adjustments or product or process inspections, and closed loop recycling or reuse of toxics.[55] The act has eight basic elements.

Industry Reporting – The state will develop a toxic or hazardous substance list and, starting in 1991, 2,400 of the state's largest toxic users, manufacturers or processors will be required to submit an annual report. The initial state list will include over 1,000 identified substances and could be expanded as required. For each substance on the list, information must be supplied about the quantities manufactured, processed, used, generated as byproduct, shipped (as is or in product) from each facility. Also, information that is reported to the federal government for the Toxics Release Inventory must be reported. Each year, the facility must also develop a by–product reduction index and an emissions reduction index, and must report specific toxic use reduction techniques implemented.[56]

Industrial Toxic Use Planning – By July 1, 1994, each toxic user must prepare a toxic use reduction plan for each facility based upon the detailed inventory reports. The plan is then certified by the state's toxic use planners for up to two years. The plan must include information about the facility's overall policy on toxic use reduction and the "planned reductions in facility–wide use and byproduct generation ... for each covered

toxic or hazardous substance during the next two years and during the next five years."[57] Then, for each production unit within a facility, a detailed analysis must be done of present and projected toxic use, by-product generation and emissions, the associated costs of toxic use, and procedures for potentially achieving reduction. The expected savings from each must be identified and an implementation schedule of the chosen techniques must be drawn up.

Performance Standards and Mandated Reductions – After July 1, 1995, the state will have the authority to impose performance standards for certain industries if satisfactory progress has not been made in preventing waste.[58] In effect, these performance standards can be considered mandated percentage reductions.

Enforcement and Tracking of Progress – All state agencies are to review their programs and amend them to promote toxic use reduction as the preferred method for achieving the goals of such programs. Enforcement of all environmental and worker health laws are to be coordinated so as to promote toxic use reduction. A multi-media inspection manual is to be developed and inspections and enforcement are to be coordinated among all agencies.[59] In addition, the state is required to ensure that

> to the maximum extent practicable, any toxics user found to be violating any law or standard for which the department has enforcement jurisdiction shall practice toxics use reduction in order to come into compliance with the violated law or standard.[60]

Provision is made for the department to order a toxic user who violates (or threatens to violate) an emission standard to prepare a toxic use reduction plan for the production unit in which the violation occurred. The department may also grant a waiver from any of the

laws it administers if a user intends to use reduction techniques in lieu of other established techniques or intends to use innovative reduction techniques.[61]

Technical Assistance – Information and assistance will be given to help achieve toxic use reduction targets. An Office of Toxic Use Reduction Assistance and Technology is established to provide technical assistance to all toxic users.[62]

Research and Development – A new Toxics Use Reduction Institute, to be operational by January of 1992 at the University of Lowell, will provide general and technical information, conduct and sponsor research and development, provide toxic use reduction training and assistance to local governments, labour groups and citizens, and train and certify toxic use reduction planners.

Toxic Use Fees – The state will discourage the use of toxic substances through imposition of a toxic use fee. A base fee will be assessed per facility, then an amount for each toxic or hazardous substance for which the facility must file an annual report will be levied. It is anticipated that the toxic use fee will raise between $4 to $5 million each year to be placed in an account reserved for the administration of the act.

Public Involvement – Citizens will be able to participate in monitoring and enforcement through entitlement to reports submitted, the right to petition the department to review a toxic use reduction plan, and a citizen suit to ensure enforcement of the Act's requirements.[63] Employees are protected from dismissal or discrimination for complying with the Act's provisions.[64]

1.3.2 Oregon

The 1989 Oregon Toxics Use Reduction and Hazardous Waste Reduction Act[65]

establishes a state-wide policy of encouraging reduction in the use of toxic chemicals and hazardous waste reduction and the setting of a state-wide reduction target of 50% by 1997.[66] It is the clear intent of the law to go beyond hazardous waste reduction and give priority to reducing toxic use.

There are a number of features to this statute, including:

Technical Assistance – The law offers financial incentives and an award or recognition for programs that have developed and implemented successful pollution prevention plans.[67] This incentive includes on-site assistance in toxics use and assistance to prepare the waste reduction plans.

Planning and Development of Toxic Use Reduction Performance Goals – Under the Act,[68] the Oregon Environmental Quality Commission (EQC) is to establish guidelines for the toxic use reduction and hazardous waste reduction plans required of regulated industries. The guidelines will require toxic users to formulate a written policy by upper management supporting the toxic use reduction plans and commit to its implementation. Toxic users are also required to develop a plan, with necessary objectives, which would include the evaluation of technologies, procedures, personnel training, to promote toxic use and hazardous waste reduction. The plan for large toxic users must be completed by September of 1991, and for small generators, by September of 1992. For some large toxic users, specific performance goals for reduction of both toxic use and waste management are required components of the toxic use reduction plans.

In addition to developing plans to meet these guidelines, the act requires industry

to:

- conduct a comprehensive toxic use audit;
- adopt a toxics use accounting system identifying toxics use and waste management, including liability and compliance costs;
- develop employee training and awareness programs for the purpose of including them in the toxic use reduction planning process; and
- identify technically and economically practicable toxic use reduction and hazardous waste reduction options.

In terms of enforcement, there is no judicial enforcement mechanism or civil penalties for failure to submit reduction plans. However, the state agency has the discretion to hold a public hearing on the plan, thereby allowing public exposure to encourage compliance.

The reduction plans remain at the facility and remain confidential, unless there is an enforcement action. The standard for review of these plans is limited to the DEQ guidelines.

As one commentator noted:

> Like the environmental impact statement requirement of the National Environmental Policy Act, the toxics reduction planning process mandated by the Oregon Act is designed to force analysis of issues previously given little attention by many businesses and governmental agencies. Thus, while the initial planning process is primarily procedural, it is expected to foster significant substantial results.[69]

1.3.3 Texas

Texas has also recently passed a pollution prevention law, the Pollution Prevention and Waste Reduction Assistance Act.[70] The Texas statute has many elements similar to those in the Massachusetts and Oregon toxic use reduction laws. Its main features can be summarized as follows:

* **institutional coordination** – establishment of the Office of Pollution Prevention and Waste Reduction (OPPWR) to coordinate and implement the state's policies pertaining to pollution prevention, and in particular, to perform waste reduction impact analyses of

Texas Water Commission rules, to advise state agencies on multimedia waste reduction, to measure progress on waste reduction, to establish and operate an information clearinghouse on pollution prevention and to develop policies to reduce the use of toxic chemicals;

* **public involvement** – establishment of a waste reduction board, composed of a broad spectrum of representatives of various agencies, government, business, the public, among others, to provide a forum for discussion, conduct research, evaluate programs, and otherwise give direction on the state's pollution prevention program;

* **research and development** – establishment of a Pollution Prevention Institute at Lamar University to, among other functions, create a planning program for individuals to be certified pollution prevention auditors;

* **reduction planning** – require certain businesses to complete a facility–wide multimedia waste reduction plan within three years and to be certified by a pollution prevention auditor; and

* **toxic inventories** – require annual mass balance inventories of toxic materials commencing in 1992 to be submitted to OPPWR.

Once commenced, the operating costs of the program would be approximately $840,000 to establish the OPPRW and Waste Reduction Board and approximately $325,000 for the Pollution Prevention Institute with an estimated state employees for fiscal year 1989.

1.3.4 Evaluation

The toxic use reduction planning approach is new and there is as yet no track record for its effectiveness in achieving pollution prevention. However, its strengths are that it requires a multi–media approach, contains a prevention target and requires monitoring and reporting. Its weaknesses include its failure to address non–point sources, its failure to effectively integrate water and air pollution laws in the context of permitting and standard–setting processes, the small financial and human resources devoted to the programs compared to the overall budget of state environmental agencies,

and the lack of a method for phasing out priority chemicals. However, despite these weaknesses, toxic use reduction laws are an important step beyond the waste reduction approach. They make certain steps mandatory for every facility, so that all toxic users must review their processes from the viewpoint of reducing toxic use. Thus, many more industries are affected compared to voluntary programs. In addition, there is a much better database on toxic use generated than would occur with voluntary programs.

1.4 Mandated Chemical Bans

Another approach to reducing the use and generation of toxic chemicals is to focus on a number of priority substances and prohibit their use, generation or disposal.

1.4.1 OECD's Sunset Chemicals Proposal

One such initiative is a recent proposal considered by the Organisation for Economic Cooperation and Development (OECD).[71] OECD member countries account for 70% of the world's gross domestic product, 70% of the world trade, and most of the world's production of chemicals.[72] In 1971, the organization established a Chemicals Program, which became known as the OECD Chemicals Group. The Group, at first, focused upon the study and control options for a select number of chemicals – PCBs, mercury, cadmium and CFCs. Later, "the work of the Chemicals Group shifted from reactive actions on specific chemicals to anticipatory programs to assess, in a coordinated fashion, the potential hazards to human health and the environment of existing and new industrial chemicals."[73] The OECD recognized that the focus on a chemical by chemical approach tends to be very resource demanding, time consuming and may lead to development of alternatives that pose other threats and still may not adequately protect

humans and the environment.

At the Thirteenth Joint Meeting of the OECD Chemicals Group, in November of 1989, Sweden proposed a systematic approach to risk management for existing chemicals. The Swedish proposal calls for management, through a system of phase-outs and bans, of chemicals that are identified as the most potentially problematic to humans and the environment.

The approach calls for the development of a list of "sunset" chemicals – that is, chemicals are identified to be phased-out or banned according to generally accepted criteria. This approach has a number of steps. These steps include:

(1) develop criteria which would identify the phase-outs, bans, or restrict uses. The criteria of these "priority pollutants" would include certain specific hazardous properties such as carcinogenicity, mutagenicity, teratogenicity or hazardousness to the environment.[74] These criteria would be assessed by an expert committee of scientists. Once the criteria are developed, a list of "sunset chemicals" which meet the criteria would be identified.

(2) The next step would be to formulate a plan to implement the phase out of the priority pollutants. The plan would include:

(a) quantitative goals for reduction of the selected chemicals within certain time frames;

(b) annual reporting on the progress of the phase-out;

(c) notice of the target dates for the phase-out of each chemical. In this instance, industry or the proponent of the

chemical would have to establish "beyond a reasonable doubt that the chemical in question is not a candidate for a sunset list." [75]

(3) The next step is the implementation of the ban or phase-out. The sunset process would allow sufficient time for the development of low-risk alternatives to feedstocks, products or processes. If a complete ban or phase-out is not appropriate, management of production processes and products would be required in such a way that exposure to humans and the environment is eliminated or minimized (such as closed loop technologies).

The proposal assumes that the plan would be implemented through national law and policy. However, it is assumed that the process must occur at the international level because so many chemicals move extensively in international trade and appear in most OECD countries. It is anticipated that the OECD initiative would set a global example toward greater cooperation and harmonization in the area of chemical management.

By March of 1990, Sweden held a workshop on sunset chemicals. At the Fourteenth Joint Meeting of the Chemicals Group of the OECD Environment Committee in May of 1990, the Group took what is thought to be a significant step in initiating risk reduction work, which would include a phase-out element, as part of its Existing Chemicals Programme. Apparently, no decision was made on how to proceed in developing criteria for risk reduction nor on what the official statement will be for the January 1991 meeting of OECD environment ministers.[76]

1.5 Other Initiatives

This section attempts to identify a number of other initiatives which have been proposed or enacted to deal with at least one aspect to the regulation of toxic contamination. One program discussed is the discharge prohibition found in California's Proposition 65.

One of the recognized problems of the current regulatory framework is the medium–specific focus. Because of this focus, pollutants removed from one medium (eg. water) may often simply be transferred to another media (eg. air). The need for a multi–media approach is now well–recognized.[77] New Jersey is one state that is proposing to overcome this problem through an innovative integrated permitting system.

Finally, another initiative, again in New Jersey, is designed to empower the public to contribute to toxics use reduction through "right–to–act" laws.

1.5.1 California

In 1986, California enacted new legislation through voter approval of Proposition 65, called the Safe Drinking Water and Toxic Enforcement Act (SDWEF)[78]. The law has a number of important and interesting features.[79]

Discharge Prohibition – The Act prohibits the discharge of listed chemicals known to cause cancer or reproductive toxicity into any source of drinking water.[80] The exception to this blanket prohibition is where the discharge or release is in conformity with all other regulatory requirements and where it will not cause any "detectable amount" of the chemical to enter a source of drinking water. The detectable amount provision is relaxed "if the exposure poses no significant risk assuming lifetime exposure at the level in question for substances [that] cause cancer, or ... will have no observable effect

assuming exposure at one thousand (1,000) times the level in question for substances [that] cause reproductive toxicity..." [81] The discharger must prove that the exposure will not exceed this threshold test. Governmental agencies and businesses with less than ten employees are exempt from the Act's discharge and warning requirements.[82]

Listing and Warning – The listing of chemicals which are considered carcinogens and reproductive toxins is required.[83] As of July of 1989, the state had listed about 300 such chemicals and set standards for 50. Once the chemical is listed, industry has 12 months to provide a "clear and reasonable" warning on products that contain the chemicals above a "no-significant risk" level. Twenty months after a chemical is listed, the substance cannot be discharged into any source of drinking water.[84] The warning requirement must alert the public where individuals may come into contact with a chemical through the water, air, food, consumer products and any other environmental exposure as well as occupational or workplace exposures. Moreover, the warning not only applies to products, but to a broader category of activities, such as dangerous workplaces. A warning may also have to be provided to people living in an area of a plant discharging chemicals on the list of covered substances.

Citizen Involvement – The public is given the opportunity to sue to enforce the discharge ban or warning requirement. The opportunity is provided for the person suing to collect a percentage of the civil penalties award.[85]

SDWEF has a number of interesting innovations. Perhaps the most important is that it reverses the burden of proof about how much of a chemical poses a significant risk. A manufacturer of a product that contains a small amount of carcinogen can only

avoid giving a warning and the prohibition by proving that the exposure will not pose a significant risk.

The second innovation is that warnings must be given for those products that expose people to a listed chemical above the threshold level. The threat of having to give warning encourages companies to find other ingredients or lower the exposure levels.

The implementation of the Act has had an interesting start.[86] The threshold for carcinogens is now defined under the regulations as a risk of 1 cancer in 100,000, a threshold less stringent than some federal standards, of 1 in 1,000,000. However, the threshold is in place for many more chemicals.[87]

The law is clear in recognizing that discharge of any toxin is allowed under the Act so long as it passes the threshold of "no-significant-risk" test.[88] The interesting innovation in this regard is that it is the discharger who must ensure that the discharge satisfies this test, and not the government agency or the public.

1.5.2 New Jersey - Integrated Permitting Proposal

The weaknesses associated with the current medium-specific approach and the need for a multi-media, integrated regulatory framework has been widely recognized.[89] Various proposals, such as the Conservation Foundation's "model statute", have been suggested to overcome these weaknesses.[90] This model statute includes a single permitting system governing the total releases of all pollutants for point sources, state management programs covering releases to all media for non-point sources, and a unified regulatory system for substances such as chemicals and pesticides.

While this model law has not been implemented, a modest attempt at integration

has been made in New Jersey. In May of 1989, the state of New Jersey introduced new legislation, the "Pollution Prevention Initiative", that would establish a pilot program for selected industries to streamline all permit applications for these industries through an Office of Pollution Prevention.[91] This process would take into account all potential cross–media transfers in controlling pollutants at each facility. The intent of this innovative initiative is to formally consider the cross–media impacts of pollution control efforts.[92] The initiative sets a state–wide goal of 50 percent reduction over five years in the use of hazardous substances, in the discharge of hazardous substances into all media, and in hazardous waste generation.

1.5.3 New Jersey – Right–to–Act Initiatives

A Right–to–Act proposal was introduced in New Jersey, known as the Hazard Elimination Through Local Participation Act (HELP), in early 1989. This law proposes to give citizens and workers the right to work together with management for workplace safety through inspections of local facilities.[93] There are several important features of this initiative. First, local emergency planning committees would either be created or expanded.

Second, community groups that have qualified through a set procedure would be given the right to periodically inspect facilities within five miles of their home, with an expert of their choice. Funding mechanisms are established to assist in attaining technical expertise. Qualified community groups are also given the right to review hazard assessments, risk analyses, and emergency planning documentation.

Third, Hazard Prevention Committees are established for facilities with 20 or more

employees. These joint labour–management committees would address hazards of an occupational and environmental nature. The committee would have the right to regularly inspect the facility and investigate accidents, to receive advance notice of new work processes, chemicals and equipment that could harm human health or the environment and cause the workplace to be shut–down until the appropriate officials arrive.

A spin–off of workplace right–to–act has been the inclusion of toxic use reduction goals in the collective bargaining process. A collective agreement, for example, could include the provision for the establishment of environment/toxic use committees with the purposes of conducting facility wide toxic audits and then developing toxic use reduction goals.

One example of this is Sheldahl Inc. of Northfield, Minnesota, the 45th largest industrial emitter of methylene chloride in the U.S. according to 1987 TRI. Contract negotiations between Sheldahl and the Amalgamated Clothing and Textile Workers Union (ACTWU) in 1990 resulted in an agreement for a 90% emissions reduction by 1993 and a 64% use reduction by 1992. The agreement also makes the development of a non–toxic alternative manufacturing process top priority in terms of capital improvements over the next two years.[94]

Similarly, community right–to–act initiatives vary from case to case. These initiatives include joint community–industry toxic reduction planning (incorporated into "good neighbour agreements") and chemical prevention strategies. These could be described in this way:

> Some local groups have led the way, by demanding the opportunity to "see for themselves" through on–site inspections of local industries. Through

> such inspections, and follow-up discussions with company officials, these citizens are evaluating the good faith of their industrial neighbours. Do the companies have a "compliance mentality," in which the EPA's weak regulations are viewed as the firms' total commitment to a clean environment? Or are the companies planning for zero toxic emissions, in [aggressively reducing] the use of toxics, and to apply all available measures to prevent a Bhopal-style chemical accident? In cases where citizen inquires show a need for improvement, local groups are negotiating for a binding Good Neighbour Agreements, in which industries agree to shift to cleaner and safer practices.[95]

By and large, the right-to-act laws are "soft" regulatory approaches, requiring reporting and planning, but not mandating enforceable facility-specific toxic reductions. Instead, they establish mechanisms for workers and community members to effectively negotiate for those reductions.

2. Pollution Prevention Programs in the Great Lakes

The jurisdictions of the Great Lakes Basin - the U.S. and Canadian federal governments, the states of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin, and the provinces of Ontario and Quebec - have been living with the obligation to virtually eliminate toxic discharges for more than a decade, yet they have been slow to embrace pollution prevention as a regulatory strategy. Recently, however, increasing interest in pollution prevention has begun to emerge in some jurisdictions in the Basin. This chapter explores progress made by Basin jurisdictions in recognizing and implementing the pollution prevention approach.

In order to elicit information about pollution prevention initiatives in the Great Lakes, a survey was drafted and distributed to approximately forty federal, state and provincial environmental agency staff in the Great Lakes in the summer of 1989. (A copy

of this survey, together with names and addresses of those to whom it was sent to, is attached in Appendix x.) The survey results provide an inventory of the pollution prevention activities being undertaken in each jurisdiction. For convenience, a summary chart of where jurisdictions stand on implementing the pollution prevention approach, as compiled from the survey and subsequent follow–up, is outlined in Table X.

The response rate for the survey was over 90%. However, while the response rate was high, the comprehensiveness of the responses were not uniform. Hence, effort was made to follow–up on incomplete responses and on issues and questions raised in the survey responses. Survey results were also updated given that this is an area where change is occurring rapidly.

The following section gives an overview of how the Great Lakes jurisdiction compare in terms of pollution prevention law and policy. The following sections then examine progress on specific components of a pollution prevention strategy. These sections discuss how each jurisdiction answers the following questions:

* Does the jurisdiction have a policy or law on pollution prevention? How is pollution prevention defined? Does it cover all media and all sources? Are there reduction targets?

* Is there technical assistance provided dealing with pollution prevention and what is the nature of this assistance?

* Are there financial incentives and disincentives relating to pollution prevention and what are they?

* What regulatory mechanisms are included in the pollution prevention programs?

* What are the institutional reforms proposed or new institutions created, such as an office of pollution prevention?

2.1 Overview

Despite the pressing need for a binational, comprehensive toxic elimination strategy for the Great Lakes, recognized since the 1978 Great Lakes Water Quality Agreement, little effort has gone into designing or implementing one.

Nevertheless, in the United States, governments at all levels are gradually beginning to make pollution prevention part of their efforts to clean up the Great Lakes. While most initiatives are aimed at giving financial and technical assistance for voluntary reduction, a few jurisdictions are instituting regulatory programs that mandate the adoption of pollution prevention. Most jurisdictions focus on hazardous wastes as the primary target for reduction, but a few, including the U.S. federal government, are beginning to take a multi-media view of the coverage of prevention programs. There are no jurisdictions that have yet supplanted existing pollution control regulatory programs with prevention programs; instead the prevention programs merely supplement existing ones.

Compared with the United States, there is relatively little action in Canada on pollution prevention. Instead, Canadian governments are only now beginning to introduce programs to encourage reduction and recycling of hazardous wastes, while the bulk of government interest and effort is still focused on reduction and recycling of municipal solid waste.

2.1.1 International/Joint Programs

While pollution prevention may not be a new concept to the Great Lakes, it certainly has not been heavily reflected in the bilateral work of the governments and bodies in the Great Lakes.

(i) International Joint Commission

Since the early 1980s, the International Joint Commission (IJC) has been recommending, and subsequently urging, the federal governments to develop a broadly based, comprehensive strategy to deal with the multiple problems of toxic substances in the Great Lakes Ecosystem.[96] The IJC's advisory boards, and in particular, the Science Advisory Board, has been especially vocal on the need for a toxics management plan, with an emphasis on prevention.[97] In its 1987 report, the Science Advisory Report noted the need for a preventive approach that would require "reduction or even elimination of toxic chemicals prior to the production and marketing processes."[98]

In its Fifth Biennial Report, the IJC, while did not specifically calling for pollution prevention, re-iterated the need for a strategy to achieve zero discharge, with such elements as reverse onus.[99] Moreover, the Commission clearly indicated its dissatisfaction with the lack of progress by the governments in developing a toxic management strategy for the Great Lakes, when it states that "there has been little movement by the Parties to implement an effective overall, coordinated toxic substance control strategy."[100] The Commission then made a number of recommendations, including:

* implementation of a binational toxic substances management strategy to provide a coordinated framework for accomplishing, as soon and as fully as possible, the Agreement's philosophy of zero discharge;

* development of appropriate legislation by all levels of government to give force and effect to the Great Lakes Water Quality Agreement;

* strengthen the notion of reverse onus for new chemicals that is, requiring manufacturers to prove safety before a new chemical can be produced;

* comprehensive reporting on governmental action to eliminate the critical pollutants;

* the designation of Lake Superior as a demonstration area for zero discharge; and

* various related research projects.

Due in part to the inaction of the governments and in part to the overwhelming plea from the public at the Fifth Biennial Meeting, the IJC initiated a series of "Roundtables on Zero Discharge" – discussions among various stakeholders – on implementing the goals of the Great Lakes Water Quality Agreement and the Commission's role. The first Roundtable was held in July of 1990 in Hanover, New Hampshire with the second planned for some time later in the year.

The IJC's boards also become very active with the creation of a joint Science Advisory Board/Water Quality Board group, the Virtual Elimination Task Force, which has been charged to develop a report on the topic by the next Biennial meeting in 1991. The Task Force will develop a comprehensive strategy for the Great Lakes to achieve the virtual elimination goal under the Agreement based on the principle of pollution prevention.

(ii) Bilateral Initiatives

In July of 1990, the national governments of Canada and the United States announced a joint task force to develop a pollution prevention strategy for the Great Lakes and the St. Lawrence River ecosystem. The task force is to report back to the EPA Administer and Canadian Environment Minister by October 31, 1990, with a draft action plan.[101]

2.1.2 U.S. Federal Programs

By and large, U.S. federal environmental programs are still geared to a medium–

specific, fragmented approach to environmental protection. Statutes that regulate air quality (Clean Air Act), water quality (Clean Water Act), drinking water (Safe Drinking Water Act), solid and hazardous waste (Resource Conservation and Recovery Act (RCRA)), regulation of certain chemicals (Toxic Substances Control Act), worker safety (Occupational Safety Health Act) lack coordination and integration. Policy objectives and regulatory assumptions often differ between the statutes.[102]

Moreover, most of the legislative programs at the federal level have taken a "pollution control" approach to protecting the environment.[103] This approach was first questioned when the U.S. Environmental Protection Agency (EPA) pursued a policy of "waste minimization" for hazardous wastes from 1984 until 1988.[104] Waste minimization applied to hazardous wastes as defined by RCRA and encouraged source reduction or recycling that reduced either the total volume or the toxicity of hazardous wastes. The statute required generators of hazardous wastes to certify, on permit applications and manifests, that they had a program in place to reduce the volume or toxicity of their hazardous wastes to the extent it was economically practicable.[105] Under its program, EPA provided information, and technical and financial assistance to facilitate waste minimization. However, the program was criticized as not sufficiently emphasizing the primacy of reduction over recycling. It directed movement away from disposal, but not toward reduction or prevention.[106]

In 1988, EPA's waste minimization program was superseded by a new initiative on pollution prevention. An Office of Pollution Prevention was created and, in January 1989, a policy statement was published in the Federal Register.[107] The new Pollution

Prevention Office (PPO) is intended to coordinate the Agency's multi-media pollution prevention strategy, which is in the process of development. While the medium-specific structure of EPA will be maintained, the Office will ensure that the pollution prevention strategy is incorporated into decision-making in all parts of the Agency including its regional offices.[108]

The primary functions of the federal program will be financial assistance for state and local programs,[109] provision of technical and other information through a clearinghouse which distributes brochures and runs a hotline and a newsletter, educational programs, audit training workshops, and the development of a pollution prevention research plan. EPA's Office of Research and Development is playing an important role in instituting many of these pollution prevention actions.

The federal government's new approach to pollution prevention is intended to focus on all toxic substances and is multi-media, that is, it will encompass air emissions and water discharges as well as hazardous wastes. To date, this broad approach has not been directly reflected in practical or concrete regulatory terms. It remains a statement of intent. Another limitation is that the policy will not directly address non-point sources.[110] In addition, the EPA's present definition of pollution prevention allows for out-of-loop and off-site recycling as acceptable techniques to achieve the goals of reduced risk.[111]

The primary approach of the EPA is to develop an understanding of prevention techniques and provide guidance and assistance to states and industry, in order to encourage their adoption. There are no targets set for achieving any specific degree of

reduction by any particular date and a regulatory approach where industry actions are prescribed is not contemplated. However, some of the coordination efforts at the PPO are intended to find ways of incorporating prevention into enforcement and permitting, and each of the medium–specific programs is reviewing its existing approaches to determine how prevention could be woven in.

In addition to the pollution prevention policy statement, there have been a number of federal legislative proposals aimed at pollution prevention in the past year or so, even though the focus remains on hazardous waste.[112] Such proposals would provide a matching grant program and technical assistance to facilitate in the development of state waste reduction programs, among other such initiatives. These initiatives are summarized in the U.S. federal summary in Appendix x.

2.1.3 U.S. State Government Programs

Generally speaking, the state governments in the Great Lakes basin have not been as innovative as other U.S. states in terms of pollution prevention. In fact, until very recently, they were fairly far behind in even recognizing the concept. Some of the jurisdictions are now recognizing the importance of the pollution prevention approach through the enactment of pollution prevention laws.

Until 1989, all states, to one degree or another, had "waste reduction" laws directed toward the reduction of hazardous waste generation. Such laws included, a hierarchy which expressed a first preference for reduction, with reuse, then recycling, and then recovery as decreasingly preferable options. The concern in all jurisdictions was a need to divert hazardous wastes from landfill disposal. However, since 1989, Indiana,

Illinois, Minnesota and Wisconsin have enacted legislation specifically dealing with pollution prevention, although these statutory enactments present quite a range in their scope and comprehensiveness. Perhaps with the exception of Minnesota, none is radical in approach or comprehensive in design: none includes pollution prevention or toxic use reduction targets; none is directly integrated with environmental approvals or standard-setting processes; and none establishes a system to ban or phase out priority chemicals.

Great Lakes state governments are starting to move away from an exclusive focus on hazardous waste and are proceeding to examine all toxic substances. However, most Great Lakes jurisdictions continue to focus on industrial point source discharges, not on toxic uses in industrial processes or on non-point sources of toxic substances. There is some movement toward a multi-media approach and toward all toxic substances associated with an industrial process. The states of New York, Michigan, Indiana, Minnesota and Illinois approach pollution prevention in a multi-media context.

All Great Lakes jurisdictions follow a non-regulatory model, in the sense that prevention is encouraged through provision of information, and technical and financial assistance. In fact, with the exception of Minnesota, the pollution prevention approach even falls short of incorporating a mandatory toxic use planning requirement, such as those adopted in Massachusetts, Oregon and Texas.

New York is the only jurisdiction in the region that has attempted to integrate prevention into its permitting process. There, hazardous waste producers and air and water polluters must undertake a pollution prevention impact statement in order to get their permits. In all other jurisdictions, the potential exists for regulators to take into

account prevention plans, although the extent to which this is done remains unclear.

Finally, a number of jurisdictions have established new departments (such as offices of pollution prevention) or other institutions (such as a pollution prevention institute). However, for all pollution prevention programs of state governments, the budget, in terms of both financial and personnel resources, is but a fraction of the overall operating budget of the environmental agency.

In sum, the concept of pollution prevention has been introduced into the Great Lakes by U.S. federal and state initiatives; it remains to be seen, however, if this concept will progress beyond a conceptual "add–on" to regulatory thinking and be integrated into the regulatory framework of each jurisdiction, supported with adequate resources.

2.1.4 Canadian Federal Programs

The Canadian federal government supports a hierarchy (reduction first, disposal last) for hazardous waste management, but exercises little effective authority over waste management. In fact, there is no formal national policy on pollution prevention, waste reduction, or toxic use. While the federal government must operate within its constitutional parameters, it may well be argued that even at that level, it has not demonstrated a leadership role in recognizing, much less furthering, a pollution prevention approach for Canada.

The Canadian Environmental Protection Act (CEPA) provides the authority for the federal government to regulate so as to prohibit the use, manufacture, release or disposal of toxic substances. This broad authority, however, has only been used on a case–by–case basis and not to institute a general program of pollution prevention. The Act does

require the Minister of the Environment to draft national objectives for waste reduction, but this has not yet been done.

One program that contains a number of elements of pollution prevention is the St. Lawrence River Action Plan, a joint federal–Quebec initiative to identify the 50 industrial plants along the River which discharge the highest proportions of toxic effluent to the River and to regulate those plants. The goal of the Plan is to reduce the toxic discharges into the River from these 50 plants by 90%.

Environment Canada has been drafting a "Pollution Prevention Strategy for the Great Lakes Ecosystem", but it is not know when this strategy will be completed. Further, it is unclear if this strategy will stand on its own or will be integrated with the joint Great Lakes strategy being developed by the Environment Canada and the EPA.[113]

The federal government's program for hazardous waste reduction contains only two elements: financial assistance to industry and support of a national waste exchange. Grants are provided through the D–RECT program for the development of innovative technology, including technology that reduces the generation of hazardous wastes. In addition, the government provides matching funds of $2 million for the On–Site program through which participating companies hire technical experts to evaluate and suggest solutions to the waste management problems of the sponsoring companies.[114] The Canada Waste Materials Exchange is federally–funded and provides companies with a referral service to exchange their wastes.[115]

2.1.5 Provincial Programs

No province has a pollution prevention program analogous to those in many U.S. states. Both Quebec and Ontario have policies that supports reduction of hazardous waste as part of a waste hierarchy. To implement the Ontario policy, the Ministry of the Environment provides information and financial and technical assistance to industries to develop "environmentally sound waste management systems with increased emphasis on the 4Rs principles."[116] The Ministry provides matching funds of up to 50% for capital and start-up costs and 100% for demonstration and research projects. Criteria for project review include the degree of toxic contaminant reduction, waste diversion potential, costs and benefits to the environment, application to other Ontario industries, and export potential.[117]

In addition to the Ministry, a Crown corporation, the Ontario Waste Management Corporation (OWMC), has a modest program to encourage waste reduction in Ontario. OWMC provides technical assistance to individual companies through on-site assessments, publications (including a manual on waste audits and reduction), technical information, lab analysis and training workshops, and some financial assistance for research projects. It also funds the Ontario Waste Exchange.

More recently, in July of 1990, the Ontario Round Table on Environment and Economy, a group composed of government leaders, industrialists and environmentalists, released a discussion paper on implementing sustainable development in the province.[118] The paper states "Six Guiding Principles" which it then applies to various topic areas, such as water, food and agriculture, waste, among others. The first stated principle is "Anticipation and Prevention". When applying this principle to water, the goal

was set to "virtually eliminate toxic discharges and continually reduce conventional pollution released to the environment".[119] The virtual elimination goal for persistent toxic chemicals is to be achieved within the decade. While the document seems very encouraging, the extent to which it will be implemented, and by what time, is unclear at this time.

In sum, programs in Canada are less comprehensive than those in the United States. None is cross-media; none addresses the generation of toxic chemicals; none has a target; none is integrated into permitting procedures; none addresses non-point sources. The focus is still on waste management through increasing use of the 4Rs. There is no preference in practice for prevention or reduction.

2.2 Policy Commitments to Pollution Prevention

In this section, a more specific review of the status of pollution prevention and its components in the Great Lakes basin is given. Each jurisdiction was considered with respect to three broad areas: policy on prevention, technical and information programs, and economic instruments.

The first area for the more specific review is the nature of, and extent to which, Great Lakes governments have committed to a policy of pollution prevention. In this context, three issues are examined:

(1) **Stated Policy and Definitions** – Has the jurisdiction committed to a policy of pollution prevention? How is pollution prevention defined?

(2) **Coverage** of Policy – What environmental areas is the policy intended to cover? Is the policy medium specific in nature or does it takes a multi-media approach (and therefore covers air, water and land)? Does the policy cover only point sources or does it cover all sources, including non-point sources?

(3) **Targets** – Do jurisdictions have stated targets for pollution reduction (such as quantitative discharge reduction goals, for example, 50% reduction targets)? What does the targets apply to (toxic chemicals, hazardous waste, or solid waste)? Have timetables been set to attain the targets? Has the preferred approach to attaining the targets (either end–of the–pipe or pollution prevention) been explicitly stated?

Each of these components of a pollution prevention policy will be dealt with below.

2.2.1 Stated Policy Commitment and Definitions

Policy commitments toward pollution prevention vary between the Great Lake jurisdictions. Some have expressed a commitment to pollution prevention in legislation or pending bills, while others have not addressed the issue at all. The jurisdictions can be divided into three groups according to the type of policy they have in place. First, there are those which have recognized **pollution prevention** as a priority, and the preferred approach to environmental protection. Second, some jurisdictions have limited their policies to waste reduction measures, such as the "4R" hierarchy (reduce, reuse, recycle, and recover). Third, a few jurisdictions, while not having any express pollution prevention or waste reduction policy, have policies against land disposal of hazardous waste or some specific waste management component.

It should be noted, however, that an express policy of pollution prevention within a jurisdiction does not mean the jurisdiction is active in promoting the approach in practice; at times, those jurisdictions without an express policy are, from a practical point of view, practising the approach in a more meaningful way.

(i) Pollution Prevention Policy

The U.S. federal government, Illinois, Indiana and Minnesota and to a more limited extent, Wisconsin, have legislation or policies that recognize pollution prevention as a

preferred approach. This approach, at least in theory, is to be broader than waste reduction regimes. However, while these jurisdictions recognize the primacy of pollution prevention, they still accept the use of end–of–pipe control methods.

The U.S. Environmental Protection Agency (EPA) has expressly stated its policy of pollution prevention in two contexts. First, it issued a formal statement in January of 1989 that recognizes prevention of the generation of pollutants, or reduction of pollutants at the source, is the optimal way of improving the environment.[120] The objectives of EPA's program are:

(1) to develop a multi–media approach by incorporating pollution prevention into policy development and implementation;

(2) to provide support for regional, state, and local multi–media prevention programs;

(3) to build a consensus for a national agenda on prevention through education and technical assistance initiatives; and

(4) to establish a strategy to develop indicators, evaluate progress, and target opportunities.[121]

The EPA puts a secondary emphasis on "environmentally sound recycling" to achieve the goal of risk reduction, although in practice, this type of recycling is synomous with pollution prevention. Further, while the pollution prevention policy articulates source reduction and recycling as preferred techniques, the agency claims that safe treatment, storage, and disposal will continue to be important pollution minimization processes. The EPA created an Office of Pollution Prevention to implement the policy and encourage state programs.

Second, pollution prevention is also recognized in the context of the Resource Conservation and Recovery Act. This Act specifically encourages waste minimization as

a preferred approach to address waste generation, although its focus is limited to hazardous waste. Under the Superfund Amendments and Reauthorization Act of 1986 (SARA), each state was required to provide assurances to the U.S. EPA that it will have adequate capacity, either in state or out-of-state, to destroy, treat, or safely dispose of all hazardous waste expected to be generated within its borders over the next 20 years. States are not eligible to receive Superfund monies for non-emergency cleanups unless the state submitted a "capacity assurance plan" by October 17, 1989.[122] Unfortunately, neither pollution prevention nor waste reduction were mandatory considerations under this process. However, many states did address their efforts at waste reduction for their reports. Moreover, the process was to limited to RCRA regulated wastes.

Apart from the U.S. federal government, the states of Illinois, Indiana, Minnesota, and, to a lesser extent, Wisconsin, have express legislation or policies recognizing pollution prevention as the preferred approach over pollution control. The strongest of the pollution prevention laws in the Great Lakes basin is the Minnesota Toxic Pollution Prevention Act, passed in May of 1990. The Act establishes state policy encouraging the prevention of toxic pollution, provides technical assistance, requires pollution prevention planning and institutes toxic use fees. While no state-wide targets for pollution prevention are set, the Act is part of the state's strategy to achieve the 40% hazardous waste reduction goal by the year 2009 established under its Capacity Assurance Plan.

The Illinois Toxic Pollution Prevention Act,[123] passed in January 1989, and a 1990 Indiana law,[124] also state that their purposes are to promote pollution prevention as the preferred means for attaining compliance with state laws and protecting the

environment. The Indiana Act also stipulates that programs implemented should "..not discourage the use of environmentally sound recycling or treatment techniques for pollution prevention that has not been prevented." Otherwise, the Minnesota, Illinois and Indiana statute generally define pollution prevention in a similar manner.

In Wisconsin, new waste reduction legislation was enacted on April 26, 1990 expressly stating that hazardous pollution prevention is the preferred method of waste minimization.[125] However, this new Act merely stresses that pollution prevention and source reduction are preferred means of combatting the problem of hazardous waste. The basic construction of Wisconsin's waste management program is similar to the 4R hierarchy discussed below.

Neither the Canadian federal government nor the province of Ontario have formally recognized the concept of pollution prevention. Instead, policy statements, to the extent they exist, rely on the waste management hierarchy. Canadian federal policy only goes as far to say that the federal government "will ensure the establishment of controls so that the life cycle of chemicals is properly managed."[126]

(ii) Waste Management Hierarchy

Unlike those jurisdictions with an express pollution prevention policy, the Canadian federal government, New York, Ontario, Pennsylvania, and Michigan have not articulated the preference of pollution prevention as opposed to pollution control. These jurisdictions still rely on the "waste reduction" approach which, essentially, attempts to deal with waste streams once generated. In this context, the "4R" hierarchy establishes the desired methods of waste minimization in the following order of preference: reduction, reuse,

recycling, and reclamation. The order of the last three techniques vary between jurisdictions. These jurisdictions encourage industry to use techniques that will reduce waste generation wherever practicable, but at the same time, end–of–the pipe pollution control methods and the other "Rs", such as recycling and reuse, are still accepted and condoned. The common feature in these programs is that they are limited to hazardous waste generation; they do not include emission reductions.

New York's Hazardous and Solid Waste Management Law[127] states that the preferred method is to reduce or eliminate the generation of hazardous waste to the maximum extent practical followed by recovery, reuse, and recycling. Land disposal is to be phased out, and therefore, source reduction is the priority. Hence, while pollution prevention is not expressly stated, certainly it is a component in this scheme.

Like New York, Pennsylvania has a hierarchy hazardous waste minimization policy with source reduction as the priority.[128] Source reduction is defined as the reduction or elimination of hazardous waste generation at its source, usually within a process. Ontario's hazardous waste management hierarchy is set out in an express written policy, the "Blueprint for Waste Management in Ontario". In the context of hazardous waste, the hierarchy establishes source reduction as the preferred method of achieving minimization followed by recovery, reuse, and recycling. Many elements of this policy have been put into regulations or are followed in practice. However, there are no obligations on industry to follow this hierarchy; it is only encouraged through financial incentives and technical assistance. In Michigan, the Waste Minimization Act, the Waste Reduction and Assistance Act, and the Environmental Technology Act, all passed in 1987, served to

strengthen waste reduction initiatives. Michigan also has a hierarchy for waste management which is laid out in the 1982 Michigan Hazardous Waste Management Plan, as required by the Hazardous Waste Management Act[129] and in a 1985 Hazardous Waste Strategy. In both instances, the clear emphasis is on waste reduction to promote the use of alternatives to land disposal for wastes which are best managed by other technologies. However, in 1990, Michigan developed a Draft Waste Prevention Strategy which takes a broader view of reduction, and sets out targets for achieving reductions and establishes the essential elements of a prevention strategy. The draft strategy was completed in October and sent out for public comments; it is expected it will be adopted in 1991.

(iii) Other Policies

The Ohio Waste Management Alternatives Program works toward reducing land disposal of hazardous waste without setting up a hierarchy system. Ohio also has a Toxic Organic Management Plan aimed at promoting best management techniques for preventing toxic waste from entering water bodies.

2.2.2 Coverage of Policy

Pollution prevention is a multi-media approach in the sense that it should address discharges to all media (water, land, and air) and address all sources, point and non-point. Many of the Great Lakes jurisdictions' policies consider all media; however, they do not establish how each medium will be integrated into the plan. In other words, many of the governments make blanket statements declaring that their policy will address toxic chemicals affecting water, air, and land without explaining how this will be achieved. In

addition, few government policies cover more than point sources. This section examines what the laws or policies cover; in summary, no jurisdiction has enacted programs to address the breadth of the term pollution prevention.

The Great Lakes governments' policies with respect to coverage can be divided into the following three categories, 1) multi-media and all sources; 2) multi-media, but only point sources, and 3) medium-specific policies.

(i) Multi-Media Covering All Sources

The U.S. EPA's Pollution Prevention policy is the only stated pollution prevention policy which expressly takes a multi-media approach in the sense of covering all media and non-point sources, as well as point sources. The objective of U.S. EPA's Pollution Prevention Office is to promote source reduction and recycling activities in order to reduce pollution in all media by working with the agency's medium-specific departments. The policy states that all sources are covered within the context of the policy. However, in practice, the clear emphasis has been on point sources reduction efforts.[130]

(ii) Multi-Media Covering Point Sources

Most jurisdictions with a pollution prevention policy or law have stated their intention to eliminate or reduce releases or discharges to all media, as opposed to hazardous wastes alone. By and large, however, their initiatives are geared toward toxic releases from point sources only. It is also fair to say that the extent of integration between waste reduction and emission reductions has not been extensive. But the exception is New York. New York's unique permitting system requires waste reduction statements from industry prior to the issuance or renewal of a waste permit. In the near

future, these statements will have to include information on multi-media toxic and hazardous waste reduction programs. Under the Act to Amend the Environmental Conservation Law, the Department of Environmental Conservation must submit a report on toxic waste reduction which covers all media. Similarly, the proposed approach in Michigan would include prevention requirements as part of the permitting process for point source dischargers.

(iii) Medium-Specific

Pennsylvania, Ontario, Ohio and the Canadian federal government have policies that are medium specific in the sense that their policies are directed toward discharges into each medium (air pollution, water pollution and hazardous waste) separately. While there may be some informal interconnections in the standard-setting and permit-issuing processes, it is certainly not mandatory or even a policy of these jurisdictions.

2.2.3 Targets

Numerical targets for the reduction in the generation or use of toxic substances are important because they define progress toward the ultimate goal of virtual elimination of toxic discharges, a goal under the Great Lakes Water Quality Agreement. No jurisdiction in the Great Lakes has set toxic use reduction or pollution prevention target, despite some progressive pollution prevention legislation. This means that no federal, state or provincial government has yet to set benchmarks to achieve the goal of virtual elimination. Michigan's proposed Waste Prevention Strategy would set targets of 50% reduction in the discharge of persistent toxic substances in to the Great Lakes by the year 2000 and of 30% reduction in the generation of hazardous waste by 2000.

Generally, those targets which have been established are aimed at only hazardous and solid waste. Some targets have been set in the context of the development of Capacity Assurance Plans under RCRA. For example, Minnesota has promised to reduce hazardous waste generation by 40% by 2009. New York has a reduction target of 50% of hazardous wastes over the next 5 years.

Wisconsin is the only state that has a target for toxic emissions, as opposed to hazardous waste. The state's aim is to reduce the release of toxic emissions to air and water by 50% over 5 years for 3 types of generators (electroplating/metal finishing; auto repair; local government/universities/trade schools). The target for hazardous waste reduction is 25% over 5 years for the 3 generators mentioned above and 25% reduction, reuse, and recycling of solid waste over 5 years.

For Michigan, the reduction of solid waste is targeted at 8–12% by 2001. Similarly, Ohio and Ontario have targeted goals to reduce, reuse and recycle solid waste generated.

While the new toxic pollution prevention laws in the Great Lakes basin do not incorporate reduction targets, the Minnesota and Indiana statutes do require that the appropriate agencies report to the Legislature of the state as to the progress in fulfilling the goals or intentions of the statute.

2.3 Technical Assistance, Research and Information Programs

Governments have relied heavily on technical assistance, research, and information programs in order to encourage industry to implement reduction technologies and methods. Technical assistance programs usually include on–site consultation,

assistance manuals, audits, workshops, student internships and training, waste exchanges, and pilot projects. Information programs usually include a clearinghouse, information manuals, seminars and workshops, education, and newsletters. Some state research programs have been set up for general studies on innovative pollution prevention techniques, while other research has been initiated to address the needs of specific problematic industries. The main purpose of this section is to determine whether jurisdictions are attempting to encourage the development of pollution prevention technologies and techniques, or whether they promote waste reduction and end–of–the–pipe approaches.

2.3.1 U.S. EPA Activities and Funding

The EPA Office of Pollution Prevention strongly emphasizes technical assistance.[131]

(i) Office of Pollution Prevention Funding of State Projects

Last year the EPA awarded grants totalling $4 million to 14 state initiated programs. In 1990, $6.8 million was distributed to 25 state–based projects connected to pollution prevention, a significant increase from last year. These programs are only partly funded by the EPA (from approximately $150K–$300k), with most of the funding coming from state sources. Michigan, Illinois, Minnesota, Indiana, Pennsylvania, and New York are the Great Lakes jurisdictions that have received EPA funding to establish pollution prevention programs. Region 5 of the EPA received five of these grants, for a total of $1,274,756.

(ii) Other EPA Initiatives

The EPA has undertaken a number of technical assistance and information programs to promote pollution prevention. For instance, Region 5 has participated in two major pollution prevention projects;[132] it is also in the process of developing pollution prevention training for federal and state employees, and developing school curricula from kindergarten through to grade 12.

The Agency has also compiled a resource guide called Pollution Prevention Training Opportunities in 1990. The guide includes information on state devised workshops, training courses, and seminars. Lists of available pollution prevention sources such as instruction manuals, opportunity assessment materials, and fact sheets are also in the guide. The Office of Pollution Prevention also publishes a newsletter on pollution prevention.

The federal agency has also established a Pollution Prevention Information Clearinghouse (PPIC). The clearinghouse includes a computerized information network called The Electronic Information Exchange System (EIES) that accesses technical information, helps with policy questions, provides an expert directory, includes a calender of pollution prevention events, provides information on technical case studies, and more.

The EPA Office of Research and Development has recently developed programs aimed at reducing the generation of wastes. These programs are undertaken by the Risk Reduction Engineering Research Laboratory in Cincinnati and have been expanded to address all environmental media. The leading programs include:

(1) the Waste Reduction Innovative Technology Evaluation Programme ("WRITE") which will undertake research on new ideas on waste reduction technologies through cooperative agreements between EPA and state governments, and between EPA and industry. There is a WRITE Research Program. A schematic

overview of this program is given in Figure x;

(2) the Waste Reduction Assessment Program ("WRAP") which has developed a waste assessment manual as a first step in encouraging industry to identify opportunities for prevention;

(3) the Waste Reduction Evaluation at Federal Sites ("WREAFS") which is a cooperative program between EPA and other federal agencies to demonstrate and encourage their adoption of reduction technologies; and

(4) the Waste Reduction Institute for Scientists and Engineers ("WRISE") which will create an institute to liaise between industry, academics, government and public interest groups on prevention projects.

It seems that these programs are oriented at least in part toward waste management, even though the EPA claims that these programs are essential to its pollution prevention program.

2.3.2 State and Provincial Activities

In addition to the EPA funded activities, there are also Great Lakes state and provincial programs that are geared toward implementing pollution prevention. Thus far, there are few. Technical assistance and information programs, and research programs will be discussed separately.

(i) Illinois, Indiana and Michigan Pollution Prevention Programs

All jurisdictions have some kind of technical assistance program in place relating to waste reduction. Hence, distinguishing them from pollution prevention programs is difficult since there will inevitably be some overlap.

Nevertheless, Illinois and Indiana have initiated the most comprehensive pollution prevention technical assistance and information programs.

Illinois has developed a Toxic Pollution Prevention Assistance Program (TPPAP)

pursuant to the recently enacted Toxic Pollution Prevention Act. The program is conducted out of the Hazardous Waste Research and Information Center (HWRIC) within the Illinois Department of Energy and Natural Resources and expands Illinois' waste reduction services to include pollution prevention.[133] The main activity of the TPPAP is on-site consultation where pollution prevention opportunities are identified and future plans are constructed. The program sponsors pilot projects for industries interested in making a commitment to pollution prevention. Education in the form of courses, seminars, conferences, faculty and student training on pollution prevention techniques is also an important component of TPPAP.

The Illinois TPPAP also provides information outreach and technical assistance programs on reduction and recycling. Notably, the HWRIC operates a clearinghouse of hazardous waste reports and the Waste Reduction Advisory System, a computerized tool used to inform generators on reduction and recycling techniques. The Illinois Environmental Protection Agency (IEPA) is involved in many of the waste reduction programs. Specifically, the IEPA assists in undertaking audits to identify opportunities for using appropriate waste reduction techniques, and conducts a waste exchange service marketing hazardous and non-hazardous wastes.

Indiana's recently established Office of Pollution Prevention and Technical Assistance (OPTA) (after July 1, 1993 the name will be changed to the Division of Pollution Prevention and Technical Assistance) and Pollution Prevention and Safe Materials Institute have mandates similar to that of Illinois' TPPAP. Under the Act, the OPTA commissioner "..shall provide general information and actively publicize the

advantages of and developments in pollution prevention."[134] The OPTA controls a clearinghouse and a Database with information on managerial, operational, and technical approaches to achieving pollution prevention. Like the Illinois TPPAP, the Indiana OPTA sponsors pilot projects and the results are made public.

Under the new Indiana legislation,[135] the Pollution Prevention and Safe Materials Institute "...shall be established by a University or not-for-profit Corporation". The Institute will develop curriculum and training on pollution prevention for students, faculty, employees of the OPTA, and auditors, plus prepare a technical assistance manual for pollution prevention planning. The manual will aid in identifying types and quantities of toxics entering or exiting the production process, operation, storage area, product, and pollution control mechanisms. The manual will assess the applicability of approaches to pollution prevention and reduction of toxic discharge. The manual will not consider any pollution control methods or mitigation of toxics other than the reduction of toxic use.

The Illinois TPPAP and the Indiana Pollution Prevention and Safe Materials Institute are involved in researching pollution prevention techniques. Both programs include assessments of a technique's impact on the environment, health, workers, as well as a financial assessment (profitability and employment). The Institute in Indiana will also develop methods of measuring the progress of industrial plants in terms of the reduction of waste generation and toxic reduction relative to production output for specific wastes (per unit of output).

Minnesota's new Toxic Pollution Prevention Act includes a Pollution Prevention Assistance Program[136] which will include information dissemination, on-site

consultations, outreach programs such as seminars, workshops, and the like. Further, the Act mandates a Pollution Prevention Grants program[137] to study or demonstrate the feasibility of applying specific technologies and methods to prevent pollution. It also has an annual Governor's Award for Excellence in Pollution Prevention.[138] The Pollution Prevention Assistance Program will serve to expand the Minnesota Technical Assistance Program (MnTAP) discussed below.

Michigan has made moves to start research on waste/source and pollution prevention reduction techniques such as production and process modification, product reformulation, product substitution, better management practices. The Michigan Technology Board, created pursuant to the Environmental Technology Act (1987), recognized that state involvement was needed to implement waste reduction research strategies. However, the idea of setting up a separate pollution prevention institute was dismissed. Instead, the board developed the Michigan Waste Reduction Partnership which is funded equally from the state and industry. The mandate of the partnership project is to increase awareness of the need for preventative reduction methods and to identify specific areas where research is needed.

(ii) Waste Reduction Technical Assistance

Most of the technical assistance, information and research programs in the Great Lakes regions focus on waste reduction and waste management techniques which usually include recycling and treatment methods. While waste reduction and pollution prevention technical assistance may often overlap, they may also differ in both approach and emphasis.

On-site consultations, information clearinghouses, workshops and seminars are the most common elements of waste management services. Other programs include information manuals, audits, waste exchange, training, internships, and pilot projects. There are some research programs, but they are not extensive.

Information Clearinghouses

The majority of jurisdictions in the basin have clearinghouses disseminating information on waste management methods. The information compiled is usually based on research results, literature on the subject, and industry sources. However, the sources, technical focus, and accessibility vary depending on the jurisdiction. By and large, these information centers tend to focus on waste reduction measures rather than innovative technologies. Most of the information centers are also fairly small-scale, often relying on published sources for information on proven technologies.

Waste Reduction Seminars and Workshops

Most of the Great Lakes jurisdictions conduct waste minimization seminars and workshops. The most salient difference between the programs lies in the audience. Some of the workshops address a broad audience in order to promote the idea of waste reduction generally, while others focus mainly on specific industries that are having problems. These workshops are not intended to be a comprehensive course in the subject, but often serve as an introduction to the topic. Apparently, these workshops are well-received by the public; however, often their generality precludes application to a facility specific basis.

On-site Technical Assistance

On-site technical assistance programs are a typical method of encouraging and facilitating implementation of waste reduction techniques. Like workshops and seminars, the on-site programs differ according to the scope of recipients. The Wisconsin Technical Assistance Pilot project (TAPP) and the Minnesota Technical Assistance Program (MnTAP) are examples of technical assistance opportunities.

In the latter instance, MnTAP was established in 1984 at the University of Minnesota to develop a technical assistance program pertaining to hazardous waste. Under this program, the staff of professionals and students provide on-site assistance to industry by evaluating production processes, reviewing engineering plans, and making recommendations on techniques to minimize waste. In addition, MnTAP offers telephone and on-site consultation, a waste reduction resource bank, information dissemination, a student intern program and research awards for waste reduction projects.[139] MnTAP is to be expanded to include the Pollution Prevention Assistance Program under the Minnesota Pollution Prevention Act.

Waste Management Audits

Waste management audits are an important part of many governmental technical assistance programs. The Wisconsin TAPP, the Michigan MRAS, Pennsylvania, New York Environmental Facilities Corporation and the Ontario Waste Management Corporation help industries conduct waste audits. These programs provide the necessary know-how to allow an industry to examine its production process and identifying waste reduction opportunities. While the intent of the programs are laudable, again the programs available tend to provide only an introduction to the topic industry. Little is

undertaken to actually encourage follow–ups and evaluations on an industry–wide basis.

Training Programs

Many of the Great Lakes jurisdictions have training programs or are in the process of developing training programs for students, auditors, and waste reduction employees. Notably, Wisconsin has a State Training Action Plan (STAP) funded in part by the RCRA Integrated Training and Technical Assistance (RITTA) grant from EPA. STAP focuses on training DNR environmental and technical assistance personnel, the industrial community on RCRA, and waste reduction and recycling. Michigan and Minnesota also have student intern programs sponsoring engineering students specializing in waste reduction to work in industry.

Pilot Projects

Wisconsin and Minnesota conduct pilot projects as part of their technical assistance programs. Like STAP, Wisconsin's Technical Assistance Pilot Project (TAPP) was funded by a federal RITTA grant. TAPP provides on–site technical assistance, business seminars, plant inspection, information outreach, and waste audits for industries experiencing compliance problems. The Minnesota pilot project is similar in that it is federally funded and applies to businesses that generate a large amount of waste solvents.

Waste Exchange Services

Illinois, New York, Pennsylvania, Ontario, and the Canadian federal government have waste exchange services as part of their technical assistance programs. In general, a waste exchange service is a marketing facility for waste. Instead of considering

chemical by-products and residues as waste, it may be possible to exchange the waste to a company who can use it productively. The waste exchange facilities usually provide an information directory on exchange opportunities.

Research on Waste Reduction

New York, Minnesota, Pennsylvania and Ontario all sponsor research on waste reduction and waste management technologies. In New York, the Center for Hazardous Waste Management at the State University of New York (SUNY) at Buffalo and in Pennsylvania, the Center for Hazardous Materials Research, conduct studies on innovative hazardous waste technologies. In Minnesota and Ontario, smaller scale research projects are undertaken based on programs with specific industries with particular problems. Most of these programs, however, are not "pollution prevention" research, but traditional treatment type approach focus.

2.4 Economic Instruments

There has been increasing emphasis in recent years on providing an appropriate mix of economic incentives and disincentives to promote appropriate individual and corporate behaviour. This trend is also apparent with pollution prevention and waste reduction programs. In fact, all of the Great Lakes jurisdictions use some form of economic instrument to encourage waste reduction. However, such measures are neither comprehensive in terms of covering uses of all priority toxic substances, nor consistent among the jurisdictions. For example, a comprehensive toxic user fee system, like the one employed in Massachusetts, has only been adopted in one jurisdiction. Moreover, there are few instances where incentives or disincentives are used to promote pollution

prevention over waste reduction.

The two most common categories of economic instruments are government grants and financial assistance programs, and a variety of incentives and disincentives.

2.4.1 Funding Assistance for Pollution Prevention Programs

The U.S. EPA Office of Pollution Prevention does not provide direct subsidies to industry for the development of pollution prevention technologies. However, the Office does provide financial support of state program under its Source Reduction and Recycling Technical Assistance grants (RRTA) program. Some $7 million will be allocated to this program. Chart X describes the Great Lakes programs sponsored by the Office. By and large, these programs are directed towards assisting state agencies and universities in enhancing their present programs, developing demonstration projects, training agency personnel and providing other resources directed toward implementing pollution prevention programs.

The Illinois program will sponsor private sector pilot projects to develop and demonstrate innovative technologies for toxic pollution prevention. The Indiana Industrial Pollution Prevention and Safe Materials program will offer grants for research and development, pilot tests, and demonstration projects that "involve commonly used industrial or commercial processes, and produce results that will be of use to other businesses".

The Minnesota Toxic Pollution Prevention Act, under its Pollution Prevention Grants Program, provides matching grants to help facilities study or demonstrate the feasibility of applying specific technologies and methods of preventing pollution. The

grant program lists criteria for selection, including those proposals that would have the greatest potential to prevent pollution, minimize the transfer of pollution from one medium to another, and develop information that can be shared with industries throughout the state. The legislation provides about $150,000 in grants for projects that assess the feasibility of pollution prevention technologies.

A bill before the Ohio assembly would have established a Toxic Chemical Release Reduction Grants Program. The grants would be have been offered on a matching fund basis for "projects that will address the feasibility of applying specific methods or technologies to toxic chemical release reduction, and that are expected to produce results with widespread application to industry in Ohio". Ohio's program would be implemented by the Ohio Environmental Protection Agency.

Waste Reduction Programs

The Canadian federal government, Ontario, Minnesota, and Michigan offer financial assistance for waste reduction projects. These programs cover the ambit of the waste reduction hierarchy, such as waste exchanges and recycling, as well as pollution prevention activities. The funds in these programs, however, tend to be quite modest.

The Canadian federal Development and Demonstration of Resource and Energy Conservation (D–RECT) program, which totals about $1 million per year, contributes up to 50% of the project costs encouraging the development of energy conservation and source reduction technologies. The Waste Management Branch of the Ontario Ministry of the Environment provides subsidies for source reduction technological development as part of its Comprehensive Funding Program for Waste Management. MOE will subsidize

up to 50% of capital and start-up costs for 4R implementation projects, process modifications and new technology applications.

2.4.2 Incentives and Disincentives

Perhaps the most direct financial disincentive to pollution is to charge a fee for discharging toxic pollutants into the environment. A number of states, including Wisconsin and Ohio, impose a fee on toxic dischargers who report under Community-Right-to-Know laws. However, the Minnesota Pollution Prevention Act expressly adopts a toxic discharge fee.

Under the Minnesota Act, facilities must pay an annual fee of $150 for each toxic pollutant released into the environment. A facility that releases more than 25,000 lbs. of toxic pollutants annually must pay two cents per pound, to a maximum of $30,000, and a facility that releases less than 25,000 lbs. must pay a $500 fee. If a plant is not subject to the fees on toxic releases but generates more than 1,000 kilograms of hazardous waste per month, it must also pay $400 annually. It is anticipated that the Minnesota fee program will raise an estimated $1.2 million annually for pollution prevention programs.

Some jurisdictions in the Great Lakes region offer tax exemptions to encourage the development of source reduction technologies. Ohio's Tax Certification program is one example. However, most jurisdictions' tax provisions do not differentiate between "pollution prevention" and "pollution control" technologies.[140] In fact, existing tax structures may discourage pollution prevention because pollution prevention techniques may require process change or material substitution and not new equipment. The tax advantage, however, is usually given for purchase of equipment, as in Canada with the

accelerated capital cost allowance write-of. Tax laws, to the extent they have an environmental dimension, are of little assistance at the present time in promoting pollution prevention.[141]

There are also some financial disincentives which assist in furthering pollution prevention. New York, Michigan, Illinois, Minnesota, and Pennsylvania, for example, impose progressively higher fees on increasingly less desirable waste management practices. These fees are imposed to implement federal policy under that landfill disposal should be the least favoured and that waste reduction should be the most preferred method for managing waste.

2.5 Regulatory Instruments

This section examines the use of regulatory mechanisms to require industry to move toward pollution prevention. A wide range of regulatory mechanisms are examined, from a "soft" regulatory approach, such as reduction planning, to the most direct approach, the banning and phase-out of substances.

2.5.1 Reporting

The 1986 federal Emergency Planning and Community Right to Know Act (EPCRA) provided for the establishment of a nation-wide database on toxic releases and requirements for state and local preparedness for chemical emergencies. This Act was enacted under Title III of the Superfund Amendments and Reauthorization Act (SARA). States prior to that time had been active in the area of information programs concerning hazardous chemicals and in fact by 1986, when the federal law was passed, some thirty-one states had hazardous information programs in place.[142]

One of the most important features of the federal Right–to–Know Law is the requirement for industrial dischargers to report their releases of toxic substances and to make this information available to the public through the Toxics Release Inventory (TRI).[143] The TRI is an annual inventory documenting the types and amounts of toxic releases at facilities which employ ten or more people, and manufacture, import, or process more than 75,000 lbs. or otherwise use more than 10,000 lbs. of TRI listed chemicals.[144] The EPCRA also directs states to appoint state Emergency Response Commissions and Local Emergency Planning Committees. These groups are responsible for emergency planning for chemical accidents. The Act directs that industrial facilities report to the community about the presence, accidental release, storage, and routine annual emissions of hazardous and toxic chemicals.

Under the EPCRA, state governments may either implement the minimum federal legislation or enact their own version, which must meet the federal requirements, but may be more stringent. In the Great Lakes region, only Wisconsin and Minnesota have enacted community right–to–know laws that are more stringent than the federal law. In both cases, reporting requirements have been extended to encompass public sector facilities. Illinois and Ohio have enacted their own right–to–know laws but these mirror the federal laws. New York, Pennsylvania, Michigan and Indiana presently implement the EPCRA.

There is no equivalent to community right–to–know laws or TRI in Canada. Ontario requires all generators of hazardous wastes to register with the MOE, but this program differs from the TRI in that they are medium specific and are much less

comprehensive in terms of the information about each facility that must be shared with the community.

2.5.2 Reduction Planning

The Massachusetts and Oregon toxic use reduction laws are essential planning mechanisms in the sense that they require facilities to plan reductions in toxic use and generation without a mandatory duty to implement those plans. This "soft" regulatory approach is thought to be advantageous for its flexibility, allowing each facility to approach toxic use reduction in its unique way, and for the cooperation it instills among stakeholders.

At this time, Minnesota is the only Great Lakes jurisdiction with a mandatory pollution prevention planning requirement, while Illinois has a voluntary program. There are other programs which, while only dealing with waste reduction, provide a small step in this direction.

The Minnesota Toxic Pollution Prevention Act requires each facility reporting toxic chemical releases under the Community Right–to–Know Act to develop a Toxic Pollution Prevention Plan to reduce or eliminate toxic pollutant releases according to legislated schedule. The plan, which must be updated every two years, must contain:

(1) a policy statement articulating upper management support for eliminating or reducing the generation or release of toxic pollutants at the facility;

(2) a description of the processes that generate or cause the release of toxic pollutants;

(3) a description of the current and past practices used to reduce or eliminate toxic pollutant generation or releases;

(4) an assessment of option to reduce and eliminate pollutants;

(5) a statement of numeric reduction and elimination objectives and schedule to achieve those objectives;

(6) an explanation of the rationale for each objective established for the facility;

(7) a list of options that were not considered; and

(8) a certification attesting to the accuracy of the information in the plan.

The pollution prevention plan remains confidential. The facility, however, must submit an annual progress report, based on the plan, to the Minnesota Pollution Control Agency (MPCA), where it is available for public review. If the MPCA determines that a report does not contain the required information, the company may be subject to an enforcement action, following a public meeting in the community where the facility is located. There is a provision that allows citizens to petition the MPCA to review deficiencies in a report. Interestingly, the planning requirements under the Act do not seem to be integrated into either the permitting or the standard-setting process.

In Illinois, under its pollution prevention law, any person may submit a Toxic Pollution Prevention Innovation plan to the agency which proposes to achieve toxic pollution prevention through the use of an innovative production process. If the plan is approved, the agency "shall make every reasonable effort to accommodate a proposed process." The accommodation may include expedited coordination and processing of any applicable permit applications and provision of appropriate technical assistance. This is a voluntary program.

In the United States, the Resource Conservation and Recovery Act (RCRA), which stipulates that "the generation of hazardous wastes is to be reduced or eliminated as expeditiously as possible," requires that generators submit a report which shows that "a

program is in place to reduce the volume or quantity and toxicity of waste". No similar requirement exists in other federal environmental legislation.

The state governments are obliged to implement RCRA requirements although they are free to go beyond them. Michigan, Ohio, Pennsylvannia, and Minnesota are states that meet the minimum requirements of the RCRA. Other states such as Illinois Wisconsin, and Indiana, which have or are developing pollution prevention legislation, go beyond RCRA requirements. New York has perhaps the most interesting approach to meeting the RCRA requirements.

The important element in RCRA from a regulatory perspective is the reporting requirement that must be met in order for a generator to operate. This requirement is made more stringent in an amendment to the Environmental Conservation Law which has recently passed the New York legislature. Under RCRA, in order to receive a permit, it is only necessary that a generator have a waste reduction plan. The New York legislation makes approval of the content of such a plan necessary and sets conditions that must be met in order to receive such approval. These conditions include evidence that there is movement up the waste reduction hierarchy in methods used (with source reduction at the top of the hierarchy), and that reasonable progress is being made on a timetable set out in the plan on a biennial basis. The New York Department of Environmental Conservation also received authority under the new legislation to integrate the planning requirement into air and water pollution regulations.

There is also the requirement of a "Capacity Assurance Plan" under RCRA, as mentioned above. These plans are not required to include waste reduction or pollution

prevention plans, but they often do.

2.5.3 Bans and Phase-outs

There are three possibilities at which regulations can prohibit the generation of toxic pollutants: chemicals, processes, and products. Of these three, only chemicals have been subject to prohibition under environmental laws in North America. Processes and products have traditionally been regulated under industry and consumer protection laws.

The constitutional division of powers between federal and local governments in Canada and the United States raise questions about which level of government has authority to ban the use of chemicals. In both countries it is not certain that local governments have full powers to ban chemicals under environmental legislation. As a result, the federal governments have taken the leadership in the regulation of chemicals.

In Canada, provincial governments can regulate the release of toxics to the environment but cannot outrightly ban a chemical from use in production. Only the federal government can do this. For example, the Ontario government may make regulations under section 136(b) of the EPA to prohibit the discharge of toxics. This would have the same effect as a federal prohibition on the manufacture of a chemical under CEPA.

Under CEPA, the regulation-making power of the federal minister seems to be sufficiently broad to incorporate bans and phase-outs. In fact, under the Act, a number of chemicals have been dealt with in such a fashion, including mirex, PCBs, dieldrin, mercury, among others. In addition, an accelerated schedule has been announced to

eliminate the production of CFCs by 1997 and phase out methyl–chloroform, an industrial solvent, by the end of the century.[145]

In the United States, the federal government has assumed the power to regulate chemicals under the Toxic Substances Control Act.[146] The Act provides for regulation of a substance (which could include a ban or phase–out) if there is a reasonable basis to conclude that "manufacture, processing, distribution in commerce, use or disposal" of that substance "will present an unreasonable risk of injury to health or the environment."[147] Section 18 of TSCA delegates the power to State governments to also regulate chemicals.

In addition, under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), the EPA cannot take action to "ban" a pesticide per se, but does have the authority to cancel or suspend the registration of a pesticide, such as DDT and dieldrin.

It could be argued that the U.S. Clean Water Act anticipated the need to ban chemicals because its intention is to eliminate the discharge of pollutants to the nation's waters. In practice, however, the notion of "elimination" has not been integrated into the technology and water quality–based standard development process.

2.5.4 Permitting and Standard–Setting

It is only in recent years when there has been some attempt to integrate pollution prevention into the traditional air and water standard–setting and permit–issuing processes under environmental protection legislation in the Great Lakes. However, this process has been neither systematic nor comprehensive. Virtually no effort has been made to integrate the pollution prevention approach in the permit–issuing process.

Despite the overall lack of integration of the pollution prevention and traditional permit–issuing and standard–setting processes, there are a number of opportunities where this integration occurs.

(i) Standard–Setting Processes

(a) Technology–Based Standards

Technology–based standards are performance limits for specific industrial categories. These performance limits are based upon certain industrial standards, such as "best practical pollution control technology" or "best available control technology economically achievable" (BATEA). Once a performance option has been selected for an industrial sector, such as petroleum refining, pulp and paper, or iron and steel, all industries within that sector have to meet those discharge limits, taking into account variability in size and production capacities of the plants.

As the name of these regulatory instruments suggests, the focus is on "control technologies", that is, end–of–the–pipe treatment and collection systems. Technology–based effluent standards have been criticized on a number of accounts. First, control technologies usually cause a partial or complete shift of pollutants from one medium to another.[148] Second, there is a propensity for additional production costs using such an approach.[149] Third, there is some question whether technology– based standards encourage technological innovation. While periodic review may demand that limits be reviewed, in the absence of any technology forcing mechanism, there is little motivation for industry to improve beyond the attainment of the specified limits. Fourth, technology–based standards put the onus on governmental agencies to assess current control

technologies in order to define the technological standard. This is necessarily resource intensive, time consuming and controversial with industry.[150]

Despite these criticisms, some modest attempts have been made to incorporate pollution prevention into technology based standards.

United States

Under the Clean Water Act, the U.S. EPA has develop effluent limits guidelines, based upon varying technological standards. By and large, existing facilities are to achieve the "Best Available Control Technology" (BAT) while new facilities are required to meet more stringent New Source Performance Standards (NSPS). Although guidelines for one industrial category remain to be completed, the EPA has largely discharged its responsibilities with respect to developing these guidelines. In January of 1990, the EPA announced its plan to promulgate new effluent limits guidelines for five categories of dischargers; to revise existing guidelines for three categories; to review existing guidelines for three categories to determine whether they should be revised; and to study further eight categories to determine whether guidelines covering them should be established.[151]

In developing the existing effluent limit guidelines, a number of courts have concluded that source reduction and recycling technologies should be considered as an available technology. In Chemical Manufacturers Association v. U.S. Environmental Protection Agency[152], the court required U.S. EPA to reconsider a number of issues in a challenge to regulations establishing effluent limits for companies that manufacture

organic chemicals, plastics and synthetic fibres. The court ruled that EPA should have considered waste-stream recycling as a model technology for issuing standards for new sources.[153]

A number of other cases have also suggested that pollution prevention measures may be legitimately considered as a BAT, especially those that work toward zero discharge, such as source reduction[154], recycling of wastewater[155] and product substitution.[156]

While recent decisions demonstrate an emerging recognition of pollution prevention as an "available" technology, there is certainly little indication that pollution prevention dominates thinking in terms of developing technology-based standards. Moreover, it is clear that there is no preference or priority of pollution prevention over traditional end-of-the-pipe technologies.

Canada

Technology-based standards at the Canadian federal level have not been updated since the 1970s, and as such, very much reflect the end-of-the-pipe approach to environmental protection.[157] The provinces of Ontario and Quebec have initiated new regulatory programs based on technology-based standards.

In Ontario, the Municipal-Industrial Strategy for Abatement (MISA) is a technology based framework initiated in 1986.[158] Throughout the latter half of 1989 and 1990, the Ontario Ministry of the Environment has attempted to develop generic guidelines or principles to govern the drafting of effluent limits. While the final determination has not been made, the Ministry and industry have proposed a position on the definition of

"available technologies" in the context of defining BAT options. The proposal defines available technologies as:

> An available technology, which may be considered as a BAT option, may be:
>
> * Changes in production processes
> * In-plant controls
> * Effluent treatment technologies
> * Best management practices
>
> or a combination thereof found anywhere in Ontario, Canada, the United States, and/or the developed industrial countries of the world in the sector or sub-sector, or a similar sector or sub-sector that produces process effluents with similar characteristics.[159]

As in the United States, MISA does not require or mandate a preference for pollution prevention over traditional end-of-the-pipe technologies. Further, at this point, there is no distinction made between existing and new sources. As well, there does not seem to be any provision which will force or even encourage technological innovation.[160]

(b) Water Quality Standards

The second branch of U.S. and most Canadian water quality laws pertains to water quality criteria which must be achieved by the discharger. While the relationship between pollution prevention and water quality criteria is not always obvious, some "inroads" have been made to establish and promote the link. One of the most direct links pertain to anti-degradation policies.

Great Lakes Initiative and Anti-Degradation

In 1989, the U.S. EPA proposed a process with the Great Lakes states and other constituencies to develop guidelines to assist states in the development of their water

quality standards for the purposes of meeting the objectives of the Great Lakes Water Quality Agreement.[161] This process has provided a forum for discussion and development of proposals on integrating pollution prevention and water quality issues.

One important area of discussion is anti-degradation policy, that is, policy designed to determine the conditions or circumstances where improvements in water quality can be foregone. One proposal[162] suggested that antidegradation be linked to pollution prevention through the following features:

> * the policy should be "triggered" by any increased loading of persistent toxic chemicals, including subject to review any activity, including land use changes and changes in agricultural and silvicultural practices;
> * all persistent and bioaccumulative toxic chemicals should be included in the policy;
> * increased loadings are "necessary" only if the proponent of the increase demonstrates that they cannot be avoided through application of a hierarchy of source reduction pollution prevention measures
> * inclusion of a presumption that region-wide benefits from increased loadings must be presumed to outweigh any short-term, localized benefits from new or increased loads of substances.

Wisconsin's Anti-Degradation Policies

The proposed pollution prevention approach to anti-degradation policy in the GLI is based in part on the precedent in Wisconsin. There a pollution prevention analysis is required prior to allowing increased loadings of persistent toxic chemicals.[163] A point source discharger proposing degradation of Wisconsin's Great Lakes waters is required to "demonstrate" that the lowering in water quality cannot be avoided through conservation, recycling, source reduction, operational changes, or alternative discharge locations.[164] If such alternatives exist, then the new pollution controls will be based on their use.[165] Wisconsin's approach, while innovative, does have a number of

weaknesses, including: its limited application to only new or increased point source dischargers; its application only to point source discharge permit applications; the low threshold with which one can demonstrate no alternative; and the limited number of chemicals involved, among others.[166]

No attempt has been made in Canada to integrate pollution prevention into water quality criteria or objectives.

(ii) Permitting Processes

One significant gap in the application of pollution prevention thus far has been its lack of integration into permit–issuing processes. In no jurisdiction examined are there multi–media permits or incorporation of pollution prevention requirements into permits.

In the U.S., while the EPA pollution prevention policy recognizes the need for a multi–media approach to permitting, it is unclear how this will be incorporated into the permitting processes under federal environmental legislation.

At the state level, two states which have pollution prevention legislation, Illinois and Indiana, recognize the need to better integrate a pollution prevention approach in all aspects of the regulatory process. In Indiana, for instance, the agency "may" seek unified reporting and permitting authority from the EPA with respect to federal air, water, and waste management legislation.[167] In Illinois, should an industry submit a voluntary pollution prevention plan, the agency is obliged to expedite the coordination and processing of any applicable permit applications.[168]

While states have not integrated pollution prevention into the permitting, there have been attempts to incorporate waste reduction planning in the hazardous waste permitting

process. In New York, for example, hazardous waste permits include a condition requiring the permittee to submit a Waste Reduction Impact Statement (WRIS) within 150 days after the permits are issued.[169] These procedures will apply, at least, until regulations that are currently under development come into force these new regulations will require owners of certain facilities to submit information on multi-media toxic and hazardous waste reduction programs. It is anticipated that these regulations will become effective in 1991.

In Ohio, the 1985 Waste Management Alternatives Program requires waste minimization to be addressed as part of the conditions for land disposal of hazardous waste at commercial hazardous waste facilities. The requirement, which applies to generators proposing to dispose of more than 200 tons per year, allows the Ohio EPA to review the plans submitted by the generators to determine if the company is working to reduce the amount of waste going to land disposal.

There are no similar programs in Canada.

2.6 Institutional Considerations

At this time, no jurisdiction has undergone a comprehensive or systematic review of agency organizational structure, function or operations, to integrate a pollution prevention approach in the agency. By and large, with few exceptions, pollution prevention is recognized, but compartmentalized as a distinct program of the agency.

The U.S. EPA and the states of Indiana, Illinois and Wisconsin have specifically established offices within their agencies to administer pollution prevention programs. The responsibility for the management of pollution prevention programs in other jurisdictions

is concentrated in waste management departments or divisions of the environmental ministries.

The U.S. EPA created the Office of Pollution Prevention in early 1989. Recently, Congress approved the appropriation of $20 million for fiscal year 1990, rising to $30 million in fiscal year 1994 to support the efforts of the Office in carrying out its activities.

Indiana has established advisory panels to work with the new Office of Pollution Prevention in that state's Department of Environmental Management. The advisory committees are to include representation from industry, education, public interest groups, and state and municipal government. The Indiana Office, however, has not yet been allocated funds for its operations.

Wisconsin has established a Hazardous Pollution Prevention Board which is to consist of representatives of the departments of industry, labour and human relations, development, health and social services, and a representative from the University of Wisconsin. The Department of Development has been allocated $86,000 for fiscal year 1990–1991 to administer its participation in pollution prevention programs. The Department of Natural Resources has been allocated $45,800 and the University of Wisconsin $139,000.

Illinois has delegated authority to the Hazardous Waste Research and Information Center (HWRIC), established in 1984 as part of the state's Chemical Safety Initiative, to manage its Pollution Prevention Assistance Program. A Toxic Pollution Prevention Fund was created in 1990 as a special fund in the Illinois State Treasury to support the pollution prevention activities of the HWRIC. The fund will be credited with monies raised

by the centre through fees, tuition, or other financial charges for participation in the HWRIC's pollution prevention programs.

3. Summary

The goal of zero discharge has been agreed to by Great Lakes governments for 12 years. It is only in that last few years that serious investigation has taken place with respect how to implement the goal, and that investigation is quite rightly leaning in the direction of pollution prevention.

In this section we have attempted to address the pollution prevention efforts of Great Lakes government. This review presents a very mixed record. Some of the findings are as follows:

(a) Pollution Prevention as a Global Movement

Even from the cursory review contained in this report, it is clear that the movement to a pollution prevention approach is international. While terms and application differ, the thrust of the movement is to prevent the use and generation of toxic chemicals.

(b) Lack of Policy Commitment

Most governments in the Great Lakes basin have not committed to pollution prevention as a way of achieving the goal of zero discharge found in the Great Lakes Water Quality Agreement. For the most part, the pollution prevention policies that have been developed arose from the recognition of the need for a better approach to environmental protection generally. There has been no guidance from the IJC or the federal governments to support this connection.

(c) Canada is far behind U.S. jurisdictions

Canadian governments have yet to introduce programs or legislation that expressly address pollution prevention.

(d) Lack of Targets, Timetables and Schedules

No Great Lakes government has set targets or schedules for achieving pollution prevention. This absence means governments are not accountable for progress, or lack of it, in moving to pollution prevention.

(e) Pollution Prevention Bias toward Point Sources

At this time, the U.S. EPA, Illinois, Indiana, Minnesota and Wisconsin have undertaken pollution prevention initiatives. The clear bias in these programs have been towards point sources. Certainly many jurisdictions have initiatives aimed at non–point sources, however, such programs have not been integrated with point source strategies.

(f) Pollution Prevention Remains an "Add–On"

Again, for those jurisdictions that have undertaken pollution prevention initiatives, the initiatives are seldom integrated into existing environmental regulations in the jurisdiction. Prevention initiatives are added on to other requirements rather than being an integral part of them. For example, there is virtually no connection in the Great Lakes of pollution prevention to standard–setting or permitting processes.

(g) Pollution Prevention Programs are Voluntary

Related to the last paragraph, in most Great Lakes jurisdictions, programs are designed to encourage, rather than require, pollution prevention. Most programs seek to provide technical information and assistance or financial incentives to individual firms seeking

assistance.

(h) Bias toward Hazardous Waste Reduction

Even for those jurisdictions with pollution prevention initiatives, pollution prevention is most concerned with hazardous wastes. The links to all environmental discharges are still not well entrenched.

(i) The Role of the Public

In all jurisdictions, the role of the public in pollution prevention remains undervalued and non-existent. This is unfortunate and unacceptable. The public and all interests must be seen as essential ingredients to these new strategies, especially for the purposes of tying in existing undertakings in the basin, such as Remedial Action Plans and Lake-wide Management Plans.

To conclude, the age of pollution prevention is at an early stage in the Great Lakes Basin. Bold new initiatives must be undertaken to ensure that the approach is implemented quickly and in a manner that moves the basin closer to the goal of zero discharge.

In the next chapter, a number of proposals are outlined which would, if it is submitted, assist in the development of a basin-wide pollution prevention strategy and address many of the concerns raised above.

III. TOWARD A POLLUTION PREVENTION STRATEGY FOR THE GREAT LAKES

Overview

In recent years, the Great Lakes have come to symbolize both the ecological tragedy arising from toxic contamination and the hope that decision–makers, private interests, and the public can find the will to work toward a healthy and sustainable ecosystem. At this time, this hope for a healthy ecosystem will remain unfulfilled until regulators take the goal of zero discharge more seriously and develop a comprehensive framework for its implementation.

A zero discharge strategy has many elements, of which pollution prevention is only one. The PZD strategy encompasses the following elements:

(1) a "toxic freeze" – to prohibit new or increased discharges of toxic substances to the Great Lakes;

(2) a ban or phase–out of bioaccumulative, persistent toxic substances substantial;

(3) substantial reduction in the use of other toxic substances; and

(4) a comprehensive clean–up strategy to clean up the legacy of past discharges.

The purpose of this chapter is to give an overview of the essential features of a pollution prevention strategy that fits within this larger zero discharge strategy. In this discussion there is overlap between many of the components. The strategy has been put in the framework of a model Pollution Prevention Act. The purpose of doing so is to provide a uniform approach to prevention that, if adopted by all Basin jurisdictions, would achieve the goal of zero discharge for the Basin as a whole. This model law is also

adaptable to the existing situation in each Basin jurisdiction. While some jurisdictions have already begun to incorporate certain elements of pollution prevention, most jurisdictions have neither focused directly on pollution prevention as distinct from waste reduction nor brought in a comprehensive strategy designed to achieve virtual elimination and integrated with existing regulatory system.

It should be noted, first, that the Model Pollution Prevention Act is proposed as a minimum for all the governments to adopt; there is latitude for individual jurisdictions to go further and implement stricter controls. Second, implementing the goal of zero discharge requires reliance on existing regulatory provisions as well as new legislation. It is not intended that the framework outlined in the model law will supplant the existing framework, particularly in the short term. Third, the proposals outlined are intended to initiate dialogue and discussion on the fundamental issues underlying them as well as in the details of each section. Therefore, this Model law is only a first step toward development of a final product. Discussion and feedback are essential to this development.

1. Implementation at the State/ Provincial Level: A Model Pollution Prevention Act

1.1 Overview

As noted earlier, it would be virtually impossible to deal with all pollution prevention issues in one statute. Instead, what is proposed is the development of a model statute which incorporates the most essential elements of pollution prevention within the context of a single statute. These essential elements include: enunciation of goals and targets;

development of a database; categorization of toxic substances; phase–out priority toxics and processes; toxic use reduction planning; integration with permitting; technical assistance; economic measures; and opportunities for public participation.

1.2 Elements of a Model Pollution Prevention Statute

1.2.1 Goals and Targets

The first sections deal with the goals and targets of a pollution prevention law:

Section 1 – Citation

This section may be cited as the Pollution Prevention Act.

Section 2 – Declaration and Policy Goals

WHEREAS the [state/province] finds:

(a) the waters of the Great Lakes ecosystem are under stress from toxic chemicals causing actual and potential harm to aquatic organisms, wildlife, and humans, including increased risk to worker health;

(b) the national governments have concluded the Great Lakes Water Quality Agreement of 1978 and its 1987 Protocol committing to the policy of virtually eliminating the discharge of persistent toxic substances and prohibiting the discharge of toxic chemicals in toxic amounts;

(c) this [state/ province] is committed to the implementation of the Great Lakes Water Quality Agreement through the Great Lakes Toxic Substances Control Agreement;

(d) there is an urgent need to restore and maintain the protection of the environment,and to promote worker safety and foster public health;

IT IS HEREBY RESOLVED THAT the most effective way of protecting the environment and promoting worker safety and public health in the [state/province] is:

(a) through the prevention in the generation, use and release of toxic pollutants;
(b) the conservation and wise use of water and energy resources;
(c) more effective implementation of existing laws and regulations;

(d) enhancement and strengthening of the enforcement of existing laws and regulations in the [province/state] and;
(e) coordination and cooperation between all departments and agencies administering programs relating to toxic substances.

Section 3 – Specific Goals

(a) General. To promote the findings of this statute in section x, the specific goals of this statute are established as follows:

1/. to identify and provide a detailed inventory of all toxic substances used, generated and released into the [state/ provincial environment];
2/. to achieve the virtual elimination of persistent toxic substances by 2010 with the phasing–out of the use and release of those substances;
3/. to attain the reduction in the use of toxic substances by 50% by 1997;

Section 4 – Definitions

In this statute,

(a) "Persistent Toxic Substance" and "Toxic Substance" means ...

(b) "Pollution Prevention" means practices that reduce, avoid or eliminate from all sources the (i) use of toxic substances, (ii) generation of toxic substances, (iii)) release of toxic substances, or (iv) manufacture of products with toxic constituents. These practices include:

1/. Input substitution;
2/. Product reformulation;
3/. Production process redesign and modification;
4/. Production process modernization;
5/. Improved operation and maintenance of production processes;
6/. Reuse and extended use of toxic substances through such methods as closed loop methods; and
7/. Product Substitution.

Comment

These sections outline the general and specific goals of the

statute. The goals of virtual elimination by the year 2010 and the 50% reduction by 1997

are intended to provide benchmarks and timetables by which to adjudge progress. The definition of pollution prevention is important because it goes beyond most of the initiatives now in place in the Basin.

1.2.2 Toxic Substance Identification

Section 5 – Toxic Substance Identification

(a) General. A Toxic Substance ID Committee shall be established with the following mandate:

> 1/. to identify toxic substances whose uses should be banned, phased–out, restricted or reduce;
> 2/. to review all approvals [permits, etc.] and identify all approvals allowing releases of persistent toxic substances; and
> 3/. to establish a timetable for implementation of these actions;

(b) Composition. The Committee shall be composed of an equal number of representatives of agency, toxic users and the public.

Comment

The ID process is intended to categorize toxic substances for the purpose of the different actions that may be taken under the Act. Priority substances will be banned or phased out and other substances will be reduced through TUR planning. The intent of the program is to provide for a systematic phase–out of persistent toxic chemicals. the range of actions would be from a ban of chemicals to identifying those chemicals whose uses would be severely restricted.

A restricted use program would include:

(a) classification of restricted use chemicals;

(b) codified requirements on restricted use chemicals;

(c) requirement that manufacturers/distributors/users, as a condition of manufacture or purchase of a restricted use chemical, develop facility specific restricted use chemical programs (along the line of product stewardship and facility planning program elements).

(d) plan elements should be included: limitations, as applicable for processing, use, and disposal of the chemical (e.g., must use recycle, closed loop, reclamation, etc.), special handling, transportation or transfer requirements; special labelling requirements, special operations, maintenance, inspection requirements, housekeeping requirements, employee training, and emergency release plans.

1.2.3 Toxic Substances Inventory

Section 6 – Toxic Chemical Inventory

(a) Commencing in 1992, all users of toxic substances are to undertake annual inventories of all toxic substances:

1/. used by the user;
2/. produced by the user;
3/. stored by the user;
4/. released by the user:
or 5/. transported off site by the user.

(b) All users must submit this information to the Agency within 60 days.

(c) Facilities included, toxic substances covered, content of the inventories, and other related required matters are to be outlined in the regulations.

(d) These inventories are to be submitted, in addition to the designated agencies, to the IJC.

Comment

For many U.S. jurisdictions, this requirement may already be in place through the Toxics

Release Inventory under SARA, Title III.

However, under this provision, more toxic substances will likely be covered. In Canadian jurisdictions, this is a new requirement. Another purpose of this section is to ensure that there is greater coordination among these data bases.

It is the intention of this section to provide a framework for the data base. Its details and implementation provisions are provided in regulations enacted under the section.

1.2.4 Pollution Prevention Audits and Plans

Pollution prevention audits plans are the most important components of the statute.

Section 7 – Pollution Prevention Audits and Plans

Every facility that uses, generates or releases toxic substances shall undertake a toxic use audit in order to determine the relationship between each process at the facility and each toxic substance used, generated or released. This audit must be undertaken within one year of the proclamation of this Act and the results must be reported to the Agency within 60 days.

Section 8 – Pollution Prevention Plans

(a) Requirement. Every facility must develop a pollution prevention plan for the purposes of meeting the goals of this statute.

(b) Substance of the Plan. The particular requirements of the plans shall be outlined in the regulations, but shall include:

1/. stated policy on pollution prevention and commitment on reaching stated goals;
2/. the results of the toxic audit for each process in the facility;
3/. an economic analysis of the costs of using, generating and releasing toxic substances, including the costs of liability, occupational hazards and rehabilitation;
4/. an analysis of each pollution technology or technique to be implemented to meet the statute's goals.

(c) The summary of the plan must be submitted by 199x. The plan must be kept on–site at all times subject to inspection in circumstances as defined under this statute.

(d) The plans must be certified by a Pollution Prevention Officer as defined in section x.

(e) Failure to File Adequate Plan. If a plan is not filed, or an inadequate one if filed, the agency may undertake one or more of the following:

1/. suspend immediately all permits and approvals for that facility;
2/. impose a fine;
3/. undertake its own plan for the facility.

(f) Incorporating Plans into Permits. Where a plan has been submitted, all permitting agencies shall take these plans into account for all future permitting procedures.

Comment

The pollution prevention plans are a new instrument in the Basin. The proposed sections require that a facility undertake a toxic audit and then establish a plan to reduce pollutants in accordance with the goals of the statute. there is no requirement that the plan be implemented, only that it be filed with and certified by the Agency and that it be taken into account when permits are applied for.

1.2.5 Toxic Fees and Grants

Section 9 – Toxic Fees

a. Facilities. All facilities releasing toxic chemicals to the environment must pay a fee for such releases in accordance with the schedule set out in regulations.

b. Pollution Prevention Fund. The monies collected from the toxic user fees shall be deposited in the hereby created Pollution Prevention Fund.

Section 10 – Pollution Prevention Grants

a. Grants. The Agency is hereby authorized to award pollution prevention grants in accordance with the criteria set out in the regulations.

b. Monies Available. The monies available to the grant program are those monies in the Pollution Prevention Fund, as outlined in section x.

Comment

These two sections provide both disincentives (fees) and incentives (grants) for toxics reduction. Fees are now used in a number of states, and most jurisdictions already have some type of grant process in place.

1.2.6 Technical Assistance

Section 11 – Technical Assistance

a. General. The Agency shall establish a technical assistance program for pollution prevention. The program shall consist of the following element:

1/. collection of information on pollution prevention techniques;
2/. provision of information on pollution prevention to toxic users and the public; and
3/. training of toxic users.

b. Demonstration Projects. The Agency is hereby authorized to undertake demonstration projects relating to pollution prevention.

c. Education Campaign. Every agency within the jurisdiction must establish a program to promote the benefits of and expose the barriers to pollution prevention.

Comment

All jurisdictions provide technical assistance in one form or another for waste reduction. This section is intended to expand those programs to pollution prevention and to provide some examples of types of programs that should be promoted.

Section 12 – Product Policy

(a) Establishment of Policy. Every facility shall develop a product policy.

TO BE COMPLETED

(b) Labelling.

TO BE COMPLETED

1.2.7 Public Participation

The following sections attempt to ensure that the public is provided with the appropriate tools to assist in the implementation of a pollution prevention approach.

Section 13 – Facility Disclosure

(a) Duties of Facility. Every facility is obliged to keep a file with the following information:

1/. all permits, approvals, or other such documents for the entire facility;
2/. toxic inventories and audits;
3/. pollution prevention plans;
4/. on–site landfills and monitoring data related thereto; and
5/. and any other material that may be designated by regulation.

(b) Disclosure. The Facility File described in (a) must be available to the agency and the Community Liaison Committee described in section x, subject to trade secret protection as established by regulations.

(c) Duties of Agency. The agency shall provide a summary of the file to any person who requests it.

Section 14 – Good Neighbour Agreements

(a) General. Any facility and community liaison committee may negotiate an agreement regarding inspection of a facility, toxic reduction, targets or plans at a facility, or any other matter.

(b) Minimum Requirements. No agreement described in (a) can be less stringent than the requirements of this statute.

Section 15 – Community Liaison Committee

(a) Community Liaison Committees. Any 10 residents located in the proximity of a facility may form a Community Liaison Committee. Every CLC must register with the agency.

(b) Powers. The powers of CLC include:

1/. review the pollution prevention plans as defined in section x, and make a finding to the agency as to their adequacy;
2/. inspect the facility, with proper notice, in accordance with the procedures outlined in the regulations;
3/. review monitoring reports and toxic use inventories; and
4/. inform the community of the activities of the CLC, and if necessary, hold meetings, publish material, and the like with the topic of pollution prevention as a theme.

(d) Citizen Suits. Any person may enforce a provision of this Statute in a court of competent jurisdiction.

Comment

Public involvement is an important element of a successful toxic use reduction program. In order to ensure public support, communication with and participation by the local community is essential. This section provides for the establishment of a formal mechanism to do this.

Section 16 – Pollution Prevention Institute

(a) Establishment. A Pollution Prevention Institute is to be established at

a university for the purposes of:

1/. undertaking research in the field of pollution prevention;
2/. training pollution prevention auditors in the pertinent areas for purposes of evaluating reduction plans;
3/. develop curricula for schools on matters relating to pollution prevention;
4/. dissemination both general and technical information on pollution prevention;
5/. other such duties as so designated.

(b) Funding. The funding for the Institute shall come from the Pollution Prevention Fund.

Section 17 – Pollution Prevention Department

(a) Establishment. A Pollution Prevention Department is to be established in the agency.

(b) The Department shall have the duty to administer the programs defined under this statute in coordination with other agency department.

Section 18 – Pollution Prevention Coordinating Committee

(a) Establishment. A Pollution Prevention Coordinating Committee is to be established.

(b) Composition. The Committee composed all managers of air, water, and waste division and headed by the head of the agency. It will also have representatives of industry, environmental, worker, academic, and municipal representatives.

(c) Reporting. The Committee reports directly to the [Governor/Premier] of the [state/province].

(d) Duties. The duties of the Committee are to:

1/. work toward to coordinate all laws, regulations, rules, and policies directed to toxic use, generation and releases;
2/. prepare an annual report on progress of this statute; and
3./ identify priorities for action.

1.2.8 Product Policy

A. General

Product policies must be developed to take into account the entire life–cycle consequences of the product on the environment from the design composition; production process; consumption; and disposal phases.

Product and consumer policy is an attempt to deal with the most fundamental question in any pollution prevention strategy: Is the product needed and what are its consequences when produced. If it is needed, then what restrictive uses program should be implemented to ensure that the product will not have negative ecological impacts.

An issue is timing – the questioning of the environmental impacts of a product must be asked before the product cause environmental harm, rather than after the fact. It is a preventive policy.

In some instances, products with unacceptable environmental consequences should not be allowed while others should be adequately labelled to give the consumer the choice as to acceptability of the product. Finally, it is essential that producers and manufacturers also must have a role to play in product policies, that of product stewardship. If producers and manufacturers are prepared to profit from certain products, they also must take responsibility in ensuring their appropriate use and disposal.

B. Product Labelling

Consumer must be empowered to make good environmental decisions. To achieve this goal, it is imperative that chemical manufacturers be required to provide to users appropriate information on product labels to assume environmental, health and safety in the use of chemical products.

C. Product Stewardship

Product stewardship involves the responsibilities of chemical producers and manufacturers to restrict some chemicals while providing methods and procedures to ensure for the appropriate use, application and disposal of chemicals.

In this instance, there must be codes of product stewardship formulated by industry and reviewed by government.

Parts of this policy may include:

* market the chemical directly to end users (no marketing through distributors);
* market the chemical only to customers who handle/use the chemical in a "safe"

manner (discontinue sale to irresponsible or "incompetent" customers); or
* discontinue production due to high liability concerns.

The challenge, however, is to ensure the implementation of product stewardship plans, since not all producers may exhibit the same level of responsibility. In these cases, regulatory requirements imposing 'product stewardship–type actions' would place the same burden on all manufacturers and users of a chemical posing serious human health or environmental concern. Uniform adoption of standards would be required which would diminish any competitive disadvantage associated with both:

(1) provision of a product stewardship program by a responsible manufacturer;
(2) responsible handling, processing, transportation, distribution in commerce, use or disposal of the chemical by the user/processor customers;"
(3) the development of education program for consumer awareness of the complete life cycle of the products;
(4) development and implementation of consumer information systems (environmental labelling); and
(5) creation of an infra–structure for recycling and reuse of discarded materials.

ENDNOTES

1. Barry Commoner, "Failure of the Environmental Effort" (1988) 18 E.L.R., at 10195.

2. T.E. Colborn, A. Davidson, S.N. Green, R.A. Hodge, C.I. Jackson, and R.A. Liroff, 1990. Great Lakes, Great Legacy?, The Conservation Foundation and the Institute for Research on Public Policy, Washington, D.C.

3. National Wildlife Federation, Is It Safe To Eat Your Catch? (1989).

4. J.L. Jacobson, S.W. Jacobson and H.E.B. Humphrey, "Effects of in utero Exposure to Polychlorinated Biphenyls and Related Contaminants on Cognitive Functioning in Young Children" Journal of Pediatrics, January, 1990.

5. Colborn et al., Great Lakes Great Legacy? (Washington: Conservation Foundation and the Institute for Research on Public Policy, 1990), at p. 181.

6. Colborn, supra, at pp. 165–167.

7. International Joint Commission, Fifth Biennial Report Under the Great Lakes Water Quality Agreement of 1978 to the Governments of the United States and Canada and the State and Provincial Governments of the Great Lakes, Part II (1989), at p. 15.

8. Toxics Release Inventory.

9. U.S. EPA, Pollution Prevention Policy Statement, January 1989.

10. Masspirg, supra, pp. 6–7.

11. In the United States, for example, strict controls on the landfilling of hazardous wastes and weak regulation of toxic air pollutants have resulted in the increased use of incineration as a preferred method of disposal. Masspirg and The National Toxics Campaign, Toxics Use Reduction, pp. 9–10. The authors refer to this as the "toxics shell game".

    Strict restrictions on air and water pollution have resulted in an enormous amount of sludge generated every year, which must then be dealt with. When sludge is landfilled, the toxic metals can leach into water or the food chain. Incineration of sludge can transfer some contaminants into the air. See discussion in Conservation Foundation, "Controlling Cross–Media Pollutants," c. 6 in State of the Environment: An Assessment at Mid–Decade (Washington, D.C.: 1984), at pp. 326–330.

12. Conservation Foundation, "Controlling Cross–Media Pollutants," supra, pp. 332–3.

13. See discussion in Paul Muldoon and Marcia Valiante, Zero Discharge: A Strategy for the Regulation of Toxic Substances in the Great Lakes Ecosystem (Toronto: Canadian Environmental Law Research Foundation, 1988), p. 30.

14. See, Conservation Foundation, "Controlling Cross-Media Pollutants," supra, pp. 323-4.

15. Environment Canada, "The Right to a Healthy Environment: An Overview of the Proposed Environmental Protection Act" (1986), at 5.

16. L.S. Ritts and R.C. Dower, Scientific, Legislative and Administrative Constraints to Multimedia Control of Toxic Substances and Hazardous Wastes prepared for the Conference on Long-Term Environmental Research and Development (Washington, D.C.: September, 1984), at p. 3.

17. Toxics Release Inventory.

18. U.S. Congress, Office of Technology Assessment, Serious Reduction of Hazardous Waste, Summary (Washington, D.C.: 198?), p. 15.

19. U.S. Congress, Office of Technology Assessment, From Pollution to Prevention, supra, p. 12.

20. See examples in Donald Huisingh, "Cleaner technologies through process modifications, material substitutions and ecologically based ethical values," in UNEP, (1989) Industry and Environment, Vol. 12, No. 1, p. 4 at p. 6.

21. This definition of "Toxics use reduction" is derived from Massachusetts Public Interest Research Group and the National Toxics Coalition, Toxics Use Reduction: From Pollution Control to Pollution Prevention, Feb. 1988, p. 14 and is now reflected in that state's Toxics Use Reduction Act, passed in July of 1989. It is also the term used in legislation in Oregon (Toxics Use Reduction and Hazardous Waste Reduction Act of 1989).

22. See, U.S. Congress, Office of Technology Assessment, Serious Reduction of Hazardous Waste and From Pollution to Prevention: A Progress Report on Waste Reduction (1987).

    The U.S. EPA uses waste minimization to refer to pollution prevention techniques defined as source reduction by product changes, input material changes, technology changes, and good operating practices, which is essentially the definition of pollution prevention used in this report. See: U.S. EPA, Waste Minimization Opportunity Assessment Manual (Cincinnati, Ohio, 1988).

23. This term is used extensively in the United Nations system. See, for example, United Nations Economic Commission for Europe, Non-Waste Technology and Production (Oxford: Pergamon Press, 1978) and United Nations Environment Programme, Industry and Environment Office, Low- or Non-Pollution Technology through Pollution Prevention (Paris, 1982).

The Organisation for Economic Co-operation and Development has defined the term "Cleaner Technologies" as "any technical measures taken in various industries to reduce or even eliminate at source the production of any nuisance, pollution or waste, and to help save raw materials, natural resources and energy. They can be introduced either at the design stage with radical changes in the manufacturing process or into an existing process with separation and utilization of secondary products that would otherwise be lost." See: OECD, "The Promotion and Diffusion of Clean Technologies in Industry" Environment Directorate Organisation for Economic Co-operation and Development, Paris, 1987).

The Commission of European Communities has a similar definition, see: Official Journal of the European Communities, No. C100/2, 20/4/1985.

24. L. Baas, et al. Protection of the North Sea: Time for Clean Production (Rotterdam: Erasmus Centre for Environmental Studies, Erasmus University Rotterdam, 1990), at 19.

25. INFORM, Inc., Cutting Chemical Wastes (New York: INFORM, 1989).

26. Generally, see: U.S. Congress, Office of Technology Assessment, Serious Reduction of Hazardous Waste: For Pollution Prevention and Industrial Efficiency, OTA-ITE-317 (Washington, D.C.: U.S. Government Printing Office, September, 1986), p. 25.

27. Discussed in OECD, Environmental Policy and Technical Change (Paris: 1985).

28. Ministere de l'environnement, Les techniques propres l'industrie francaise, (Les cahier techniques de la Direction de la Prevention des Pollution no. 21, Paris, 1986; Karmali, supra, at p. 116.

29. Eramsus, supra, p. 15.

30. ICF, California report.

31. Karmail, supra, at 108.

32. U.S. Congress, Office of Technology Assessment, Serious Reduction of Hazardous Waste: From Pollution Prevention OTA-ITE-317 (Washington, D.C.: U.S. Government Printing Office, Sept. 1986), at p. 37.

33. Karmali, supra, p. 112.

34. R.A. Westin and S. Gaines, "The Relationship of Federal Income Taxes to Toxic Wastes: A Selective Study" (1989), 16:4 Boston College Environmental Affairs Law Review 758.

35. L. Edelman and D.K. Rozell, "Oregon's Toxics Use Reduction and Hazardous Waste Reduction Act: A Bellweather for Pollution Prevention Regulation" (1990), 20 ELR 10093 at p. 10095.

36. Edelman, at p. 10095.

37. Karmali, supra, p. 108.

38. There are many names for "clean technology policies", including low and non waste technology, innovative technology, cleaner technology and clean production policies. While there are subtle differences between these concepts, they will be discussed in the same group for convenience.

39. See: Abyd Karmali, "Stimulating Cleaner Technologies Through the Design of Pollution Prevention Policies: An Analysis of Impediments and Incentives" (Masters of Science Thesis, Massachusetts Institute of Technology, May 1990), pp. 135–142. Also see: Organisation for Economic Co–operation and Development, "The Promotion and Diffusion of Clearer Technologies in Industry" Environment Monograph, No. 9, (Paris: OECD, 1987).

    For review of the 1986 Waste Avoidance, Recycling and Disposal Act in Federal Republic of Germany, see: H. Sutter, "Low–Waste Technologies in the Federal Republic of Germany" (1989), 11 The Environmental Professional pp. 190–198.

    For initiatives in Denmark, see: K. Christiansen and J. Kryger, "Promotion and Implementation of Cleaner Technologies in Danish Industries" (1989), 11 The Environmental Professional pp. 199–208.

40. See: E.M. Matilla, "Clean Technologies Policy of the European Economic Community" in UNEP, Industry and the Environment, (1989), Vol. 12.1, pp. 11–13. Karmali, supra, at pp. 134–135.

41. The term was defined as follows:
    "The concept of "clean technologies" covers three distinct but complementary purposes:
    ––less pollution discharged into the natural environment (water, air and earth),
    ––less waste; this is why reference is often made to low–waste or non–waste technologies,
    ––less demand on natural resources (water, energy and raw materials)."

42. Official Journal No. C.169, 29.06.1987. The environmental policy appears in Article 130R of the modified Treaty of Rome.

43. Official Journal No. L.176, 03.07.1984; Official Journal No. L.207, 29.07.1987.

44. Dutch Ministry of Housing, Physical Planning and Environmental Affairs, 1989. Netherland's clean technology policy is reviewed in L. Baas, et al., Protection of the North Sea: Time for Clean Production (Rotterdam: Erasmus Centre for Environmental Studies, Erasmus University, February, 1990), pp. 14–15; 54–64.

45. Baas, et al., Annex II, at p. 61.

46. Volume I: The Role of Waste Minimization, National Governor's Association, National Resources Policy Studies Unit, Center for Policy Research, 444 North Capitol Street, Washington, D.C., 1989, at p. 13.

A good example of this approach is the State of Rhode Island.

The first steps were the establishment of technical assistance programs in New York and Pennsylvania in 1981. In 1983 the comprehensive North Carolina Pollution Prevention Program was launched. By 1989, there were hazardous waste reduction programs in 35 states. Roger Schecter, Director, Pollution Prevention Program, North Carolina Department of Natural Resources and Community Development, remarks at Conference on "Pollution Prevention: A Multi–Media Response to the Toxics Release Inventory," Woods Hole, Mass., June 21–23, 1989.

See: R.T. Enander and V.A. Bell, "Hazardous Waste Reduction Initiatives and the State of Rhode Island" (April, 1990), vol. 40, no. 4 J.Air Waste Manage. Assoc. pp. 510–512.

47. National Governors' Association, Vol. 1: The Role of Waste Minimization, supra, at viii.

48. National Governors' Association, Vol. 1: The Role of Waste Minimization, p. viii.

49. National Governors' Association, Vol. 1: The Role of Waste Minimization, supra, at p. ix.

50. Schecter, supra.

51. See, Council of State Governments, Center for the Environment and Natural Resources, Status of State Hazardous Waste Reduction and Minimization Programs, Final Report, July 1989, in State Actions for Reducing Hazardous

Wastes, August 1989.

52. North Carolina Department of Environment, Health, and Natural Resources, Pollution Prevention Program, Overview of the Pollution Prevention Program; North Carolina's Initiative, 1989.

53. North Carolina Department of Environment, Health and Natural Resources, Overview of the Pollution Prevention Program, supra.

54. Reduction of Hazardous Substances and Hazardous Waste Act, Bill 2390, February, 1990, State of Washington. This Act, which has, as its stated policy objective the reduction of 50% of hazardous waste by 1995, provides for voluntary reduction plans by industry. While the plans remain confidential by industry, any 10 persons residing within ten miles of a facility that has been required to prepare a plan may file a petition with the Department of Ecology requesting examination of the Plan to determine its adequacy. The Department may deny a petition if it has determined the Plan to be adequate within the previous year [s. 10(2)].

    Also see: R.B. Pojasek, A Summary of Washington State's Reduction and of Hazardous Substances and Hazardous Waste Act, April, 1990.

55. Mass. Act, s. 2.

56. Massachusetts Toxics Use Reduction Act, section 10.

57. Massachusetts Toxics Use Reduction Act, supra, section 11(2).

58. Mass. Act, section 14.

59. This coordination function will be played in part by the Department of Environmental Quality Engineering and in part by the newly created Administrative Council on Toxics Use Reduction. See sections 3 and 4.

60. Mass. Act, s. 3(E).

61. Mass. Act, sections 16 and 17.

62. Mass. Act, s. 7.

63. Mass. Act, s. 18.

64. Mass. Act, s. 23.

65. Ch. 833, secs. 2–16, 1989, Or. Laws (codified at Or. Rev. Stat. ss. 465.003–.034).

66. For a more detailed review of the history and contents of the Oregon law, see: Hansen, "Pollution Prevention Planning, a New Mandate for Oregon's Environment" (1989), Envtl. F., Sept.–Oct. 1989, at 30; L. Edelman and D. K. Rozell, "Oregon's Toxics Use Reduction and Hazardous Waste Reduction Act: A Bellweather for Pollution Prevention Regulation" (1990), 20 E.L.R. 10093.

67. Oregon law, s. 12.

68. Oregon law, ss. 7–8

69. Edelman, supra, p. 10094.

70. Pollution Prevention and Waste Reduction Assistance Act (S.B. 1503), Title 71 Revised Statutes, Article 4477–9c.

71. There are currently 24 OECD countries: Australia, Austria, Belgium, Canada, Denmark, FRG, Finland, France, Greece, Great Britain, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden. also indicates 12 members are also members of the European Community (EC).

72. Organization for Economic Cooperation and Development (OECD), The Chemicals Program (Paris: OECD Publications, Paris, France, 1989).

73. Foran, p. 3.

74. Wahlstrom, Nature, p. 276.

75. Wahlstrom, Nature, p. 276.

76. This initiative could be seen as an operational mode for such obligations as those undertaken in such instruments as the Bergen Ministerial Declaration from May ECE Conference. This Declaration has a section on sustainable industrial activities which includes a call for setting regional timetables for phasing out use and emission of hazardous substances that are toxic, persistent and bioaccumulative and cannot be adequately controlled. Irwin, Memo, May 25, 1990]

77. B.G. Rabe, Fragmentation and Integration in State Environmental Management (Washington, D.C.: Conservation Foundation, 1986); P. Muldoon and M. Valiante, Zero Discharge – A Strategy for the Regulation of Toxic Substances in the Great Lakes Ecosystem (Toronto: CERLF, 1988); Conservation Foundation, Controlling Cross–Media Pollutants (Washington, D.C.: Conservation Foundation, 1984). Also see: W.K. Reilly, "The Turning Point: An Environmental Vision for the 1990s"

(1989), Environmental Reporter, pp. 1386–1390.

78. Safe Drinking Water and Toxic Enforcement Act, California Health and Safety Code, Chapter 6.6, ss. 2549.5 to 2549.13 (West, 1988).

79. For further information on the law, see: "California's Proposition 65: Incentives to Limit Toxic Exposures" Health and Environment Digest, Vol. 3, No. 7, August 1989, 1.

80. CH&SC S. 2549.5

81. CH&SC 25249.11

82. CH&SC 25249.11

83. CH&SC 2549.8

84. CH&SC 25249.9–10

85. CH&SC 25249.7 and 25192

86. For an in–depth analysis, see: W.S. Pease, "Environmental Pollution and Cancer in California: Evaluating the Significance of Risks Under Proposition 65" (Masters Thesis, University of California, Berkeley, May 2, 1988), Chapter IV.

87. "California's Proposition 65:...", supra, p. 2.

88. See: MEMO, From: David Roe, Environmental Defense Fund, To: Those Interested in Proposition 65, Issue: Zero Discharge, Dated: July 17, 1986.

89. P. Muldoon and M. Valiante, Zero Discharge: A Strategy for Regulation of Toxic Substances in the Great Lakes Ecosystem (Toronto: Canadian Environmental Law Research Foundation, 1988), chapter 4; R.W. Hahn and E.H. Males, "Can Regulatory Institutions Cope with Cross Media Pollution" (1990) J.Air Waste Manage.Assoc. at 24.

90. Conservation Foundation, The Environmental Protection Act, September, 1988, Section–by–Section Analysis.

91. State of New Jersey, Senate Bill No. 3581, Introduced May 8/89.

92. Barry G. Rabe, "Environmental Regulation in New Jersey: Innovations and Limitations" 1990, pp. 15–16.

93. State of New Jersey, Assembly No. 2832, 1989.

Also, see: Pennsylvania Public Employee Occupational Safety and Health Act – 1989 filing, right to refuse hazardous work, mandatory joint labour–management health and safety committees, non–discrimination rights against workers involved in health safety committee.

94. Working Notes on Community Right–To–Know, A Working Paper on Our Right–To–Know About Toxic Pollution, July 1990, p.1

95. S.J. Lewis, "The Good Neighbour Agreement – A New Style of Environmental Regulation" (1990) Toxic Times, vol. 2; no. 1, at p. 6.

96. For example, see: International Joint Commission, Third Biennial Report Under the Great Lakes Water Quality Agreement of 1978 to the Governments of the United States and Provinces of the Great Lakes Basin, December, 1986, at p. 19. Also see: International Joint Commission, Fifth Biennial Report Under the Great Lakes Water Quality Agreement of 1978 to the Governments of the United States and Provinces of the Great Lakes Basin, Part II, 1990, at p. 10–11 [where previous IJC's recommendations reviewed].

97. For instance, see: Great Lakes Science Advisory Board, Report to the International Joint Commission, 1987 Report, presented at Toledo, Ohio, November, 1987, at 21; Great Lakes Science Advisory Board, Report to the International Joint Commission, 1989 Report, presented at Hamilton, Ontario, September, 1990, pp. 69–70.

98. Supra, note 21.

99. IJC, 1990 Biennial Report, p. 8.

100. IJC, 1990 Biennial Report, p. 12.

101. Environment Canada, Release, "De Cotret and Reilly Set Date for Air Quality Negotiations", Ottawa, July 16, 1990.

102. P. Muldoon and M. Valiante, Zero Discharge A Strategy for the Regulation of Toxic Substances in the Great Lakes Ecosystem (Toronto: Canadian Environmental Law Research Foundation, 1988), at p. 30. Also see: L.B. Lave and E. Males, "At Risk: The Framework for Regulating Toxic Substances" in Environmental Science and Technology, vo. 23, no. 4, p. 386.

103. There are a number of technology forcing provisions in various statutes, however. Moreover, both the Clean Air Act and the Clean Water Act have innovative technology waiver (ITW), which allow industry time extensions for compliance if innovative technologies are going to be used. However, these sections are rarely employed.

104. This policy flowed out of the 1984 amendments to the Resource Conservation and Recovery Act (RCRA) which, in section 1003 (b) declared it to be the

> "national policy of the United States that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. Waste that is nevertheless generated should be treated, stored or disposed of so as to minimize the present and future threat to human health and the environment."

Hazardous and Solid Waste Amendments of 1984, (Public Law 98–616).

105. U.S. Environmental Protection Agency, Report to Congress: Minimization of Hazardous Waste, Executive Summary and Fact Sheet, October 1986, p. xiii.

106. See, especially, U.S. Congress, Office of Technology Assessment, From Pollution to Prevention: A Progress Report on Waste Reduction, (Washington, D.C., June 1987), pp. 9–10.

107. This statement is contained in the Jan. 26, 1989 notice in the Federal Registrar (54 FR 3845).

108. U.S. Environmental Protection Agency, Policy Statement on Pollution Prevention, January 1989.

109. For fiscal year 1991, a pool of funds amounting to 2% of regional research budgets was reallocated to pollution prevention. The funds were assigned to new projects submitted by the regions. See below.

110. However, the Office of Water is investigating ways to use pollution prevention in its non–point source programs. PP News...

111. EPA Statement, p. 7.

112. For example, see: Waste Reduction Act,H.R. 1457, 101st Cong. 1st Sess. (1989). All see: S. 585, 101st Cong. 1st Sess (1989), introduced by Rep. Wolpe and Sen. Lautenberg, respectively.

See: Bureau of National Affairs, Environmental Report, 10–13–89, p. 1052; Senate Bill No. 14 – Hazardous Waste Source Reduction and Management Review of Act of 1989 (October 1, 1989).

113. Supra.

114. On–Site is sponsored by a private consulting firm, Energy Pathways Inc.

115. The waste exchange is run by Ortech International.

116. Ontario, Ministry of the Environment, The Comprehensive Funding Program for Waste Management: Facts for Industries, July 3, 1987.

117. Ontario, Ministry of the Environment, Comprehensive Funding Program, supra, and William M. Glenn, Waste Management Initiatives in Ontario, A Summary Report, June 15, 1987, p. 3.

118. Ontario Round Table on Environment and Economy, Challenge Paper (Toronto: Queen's Paper, 1990).

119. Ontario Round Table, supra, pp. 6; 12–13.

120. This statement is contained in the Jan. 26, 1989 notice in the Federal Registrar (54 FR 3845).

121. U.S. EPA, EPA's Pollution Prevention Program, An overview prepared by the Risk Reduction Engineering Laboratory for Waste Minimization Workshop Series, 1989, p. 1.

    Also see: G. Kotas, "EPA's Pollution Prevention Program: Progress and Opportunities" (1989), The Environmental Professional, Vol. 11, pp. 186–189.

122. SARA, section 104(k)

123. Illinois Toxic Pollution Prevention Act, SB 1044 (January, 1989).

124. Bill amending the Indiana Code concerning the environment (House Enrolled Act No.1106). Under the Act, "Pollution Prevention" is defined as the employment by a business of a practice that reduces the industrial use of toxic materials or reduces the environmental and health hazards associated with an environmental waste without diluting or concentrating the waste before the release, handling, storage, transport, treatment, or disposal or the waste. The term includes changes in production technology, materials, processes, operations, or procedures, of the use of in process, in–line, or closed loop recycling according to standard engineering practices.

125. Wisconsin Act #325, House Bill 736; "Pollution Prevention" is defined as the reduction of the use and production of hazardous substances through implementing technology and process changes.

126. Environment Canada, Federal Water Policy, 1988, at p. 17.

127. s. 27–0105 Environmental Conservation Law

128. Pennsylvania Hazardous Waste Facilities Plan, July 1988.

129. Hazardous Waste Management Act, Act 64, P.A. 1979.

130. Michigan's proposed strategy includes a goal of reducing discharge to the Great Lakes from point and non-point sources are not clear from the draft.

131. See: G. Kotas, "EPA's Pollution Prevention Program: Progress and Opportunities" (1989), vol. 11 The Environmental Professional, pp. 185-189; H.M. Freeman, "The USEPA Pollution Prevention Research Program", A paper presented at the California Department of Health Services Symposia, "Metal Waste Management Alternatives", September , 1989, Pasadena and San Jose, California.

132. These are:

Environmentally Responsible Management of Agricultural Chemicals and Pollution Prevention Through Agricultural Chemical Management

Reduction of Toxics in Emissions and Ash from Municipal Waste Combustors

133. See: D.D. Kraybill and D.L. Thomas, "Waste Reduction in Illinois: An Overview" in 42nd Purdue University Industrial Waste Conference Proceedings (1987), at 321 et seq.; D.L. Thomas, "Illinois Program to Industrial Waste Reduction" August 26, 1990.

134. Indiana House Enrolled Act No. 1106 (IC 13-9-2).

135. Indiana Code, IC 13-9-4.

136. Minn. Act, section 4.

137. Minn. Act, section 5.

138. Minn. Act, section 6.

139. See: F.M. Thompson and C.A. McComas, "Technical Assistance for Hazardous-Waste Reduction" (1987), 12 Environ. Sci. Technol. at 1154.

140. Find cite for pollution control tax advantages under the Canadian Income Tax Act.

Generally, see: R.A. Westin and Sanford Gaines (1989), "The Relationship of the Federal Income Taxes to Toxic Wastes: A Selective Study" in Boston College Environmental Affairs Law Review, Vol. 16, No. 4.

141. Karmali, supra, at p. 118.

142. R.A. Kanerva, "Interrelationship Between Federal and State Emergency Planning and Right-To-Know Laws" in The Community Right-To-Know Handbook (?: Thompson Publishing Group), at p. 49.

143. In the first reporting year, 1987, it was summarized that some 22.5 lbs. of toxic chemicals were released to the environment in 1987, including 550 million lbs. to water, 2.6 billion lbs. to air and 2.4 billion shipped offsite. See: EPA Summary.

Also see: National Wildlife Federation, The Toxic 500 - The 500 Largest Releases of Toxic Chemicals in the United States 1987 (August, 1989).

144. EPCRA, Section 311/312.

145. Craig McInnes, "Canada Pledges Speedier Moves to Protect Earth's Ozone Layer", Globe and Mail, July, 1990.

146. Toxic Substances Control Act, 15 U.S.C. ss. 2601-2671.

147. TSCA, s. 6(a).

148. L. Baas, et al., Protection of the North Sea: Time for Clean Production (Rotterdam: Erasmus Centre for Environmental Studies, Erasmus University, 1990), at p. 11.

149. Ibid., - [L. Baas, et al., Protection of the North Sea: Time for Clean Production (Rotterdam: Erasmus Centre for Environmental Studies, Erasmus University, 1990), at p. 11]

150. See: J.M. Gaba, "Regulation of Toxic Pollutants Under the Clean Water Act: NPDES Toxics Control Strategies" (1984/85), 50 Journal of Air Law and Commerce 761, at 768-69; B.W. Wyche, "The Regulation of Toxic Pollutants Under the Clean Water Act: EPA's Ten Year Rulemaking Nears Completion" 15 Natural Resources Lawyer 511, at 512-13.

151. Environmental Protection Agency, Notice of Plan to Review and Promulgate Effluent Guidelines Regulations, 55 Federal Register 80, January 2, 1990.

152. Chemical Manufacturers Association v. United States Environmental Protection Agency, 870 F.2d 177 (5th Cir. 1989); 19 E.L.R. 20989.

153. The court stated: We know from the record that 36 plants in the industry use recycling and some of them achieve zero discharge. Thus, recycling easily fits the definition of an "available demonstrated technology" under s. 306 of the Act.

The failure of the EPA even to consider recycling, then, was arbitrary and capricious. Ibid., at 19 ELR 21030.

154. EPA Region X has recommended that recycling and source reduction be considered a "fuel cleaning technology" under available control technology provisions for a Clean Air Act permit. See: (1989), Environment Reporter, p. 2565.

155. Kennecott v. United States Environmental Protection Agency, 780 F.2d 445 (4th Cir. 1985); 16 ELR 20435.

156. See: American Petroleum Institute v. United States Environmental Protection Agency 858 F.2d 261 (5th Cir. 1988, amended Jan. 26, 1989); 19 ELR 20317.

157. Find cite for this statement.

158. See: Ministry of the Environment, Municipal–Industrial Strategy for Abatement, A Policy and Program Statement of the Government of Ontario on Controlling Municipal and Industrial Discharges into Surface Waters, June, 1986.

159. Environment Ontario, "MISA Issues Resolution Process: Issue Resolution Committee Report", June, 1990, at p. 90.

160. See: Canadian Institute for Environmental Law and Policy, et al., "Working toward Zero Discharge: Response to MISA's Issues Resolution Process" (August, 1990).

161. EPA, Great Lakes Water Quality Initiative, June, 1989.

162. Mark Van Putten, Natural Resource Center, National Wildlife Federation, Letter and Proposal to B. Vaughn of Water Standards and Planning, U.S. EPA Region II and A. Bramberg, Water Division, New York Department of Environmental Conservation, "Great Lakes Initiative Antidegradation Policy", June 8, 1990.

163. Wisc. Admin. Code NR 207.03(3), reprinted at Environmental Reporter (BNA), State Water Quality Laws at 951:0512 (cross referencing NR 207.04, which included these requirements).

164. Wisc. Admin. Code NR 207.04(1)(d)(1); reprinted at Environment Reporter (BNA), State Water Laws 951:0512.1.

165. Id., at NR 207.04(2)(c)(2), BNA at 951:0512.2.

166. Mark Van Putten, Natural Resource Center, National Wildlife Federation, Letter and Proposal to B. Vaughn of Water Standards and Planning, U.S. EPA Region II and A. Bramberg, Water Division, New York Department of Environmental

Conservation, "Great Lakes Initiative Antidegradation Policy", June 8, 1990, at p. 8.

167. Indiana, section 7.

168. Illinois Toxic Pollution Prevention Act, section 6.

169. N.Y. Environmental Conservation Law, Part 373, sections 27-0105 and 3-301(1)(b).