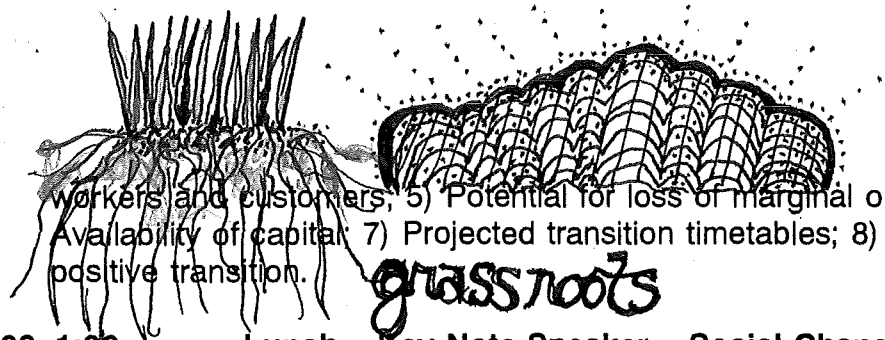

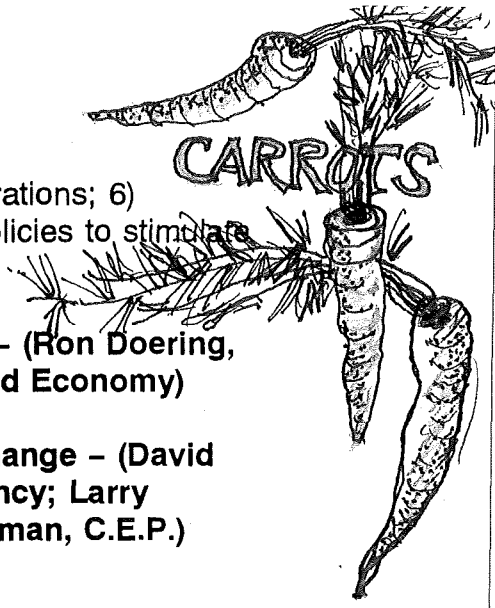

workers and customers; 5) Potential for loss of marginal operations; 6) Availability of capital; 7) Projected transition timetables; 8) Policies to stimulate positive transition.

12:00–1:00 **Lunch – Key Note Speaker – Social Change – (Ron Doering, National Round Table on the Environment and Economy)**

1:00–2:30 **Opportunities for Transition – Stimulating Change – (David McRobert, Workplace Health and Safety Agency; Larry Kwicinski, University of Waterloo; Keith Newman, C.E.P.)**

Prioritizing Sectoral/Product Based Chemical Phase–outs
Identifying Alternatives
Funding and Institutional Support for Technology Change
Income Support and Training for communities and workers
Community Participation, Right to Know, consensus building
Leadership and Partnerships – NGO–Government–Labour–Private Sector
Identifying policy options and choices.

2:30–2:45 **Break**

2:45–4:15 **Action Plans for Transition – (Paul Muldoon; Doug Macdonald)**

The purpose of this section is to arrive at a concrete Action Plan with the following components:

1) What are the specific policies, processes and activities that need to take place to facilitate and support transition for workers, communities and industry?

2) Who are the individuals, activists, organizations or partnerships that will be leading the next phase of sunsetting chemicals?

3) Which sectors, products or industrial processes will be targeted?

4) Which decision–makers need to be targeted and how are they best approached? Which governments and institutions need to be involved?

5) When will phase–outs take place and what are realistic measurable time–tables for the phase–out of targeted processes or products?

4:15–4:30 **Closing Remarks**

POLLUTION PROBE

APR 8 1994

SUNSETTING CHEMICALS IN THE GREAT LAKES BASIN:
Economic and Social Transition Planning

DRAFT AGENDA

Location: **Ramada Hotel, 89 Chestnut Street, Toronto, Ontario, M5G 1R1**
Date: **Thursday April 14, 1994**

Co-sponsored by Pollution Probe, the Centre for Society, Technology and Values (University of Waterloo) and the Windsor and District Labour Council - Environment Project.

8:15-8:45 **Registration and Coffee**

8:45-9:00 **Introduction and Workshop Objectives**

9:00-10:00 **Overview of Sunset Chemicals and the Virtual Elimination Framework - (Paul Muldoon, Pollution Probe/CELA; Tom Muir, Canadian Centre for Inland Waters, Environment Canada)**

This section will provide the overall context for the workshop and provide information so that all participants understand the issues. Where are we at with respect to sunsetting chemicals? What is the Virtual Elimination Framework and how can it be applied? What are the key policy issues? What are the social, economic and political barriers to sunsetting chemicals?

10:00-10:30 **Defining Transition - (Sally Lerner, University of Waterloo)**

What do we mean by "transition planning"? What kinds of economic and social considerations are important? How will transition planning lead us to an economy and society which is cleaner and healthier for workers, communities and ecosystems?

10:30-10:45 **Break**

10:45-12:00 **Dry Cleaning Industry Case Study - (Bonnie Rice, Greenpeace; Jack Weinberg, Greenpeace; Diane Wieser, Eco-Franchising)**

We will use the Dry Cleaning Industry Case Study commissioned by Pollution Probe and prepared by Greenpeace as an example for concrete discussion on how transition planning can be applied to the sunsetting of the dry cleaning solvent perchlorethylene. Specific issues will include: 1) The role of process and technology change; 2) Assessment of alternatives; 3) Industry composition, both users and manufacturers of "perc"; 4) Benefits of phase-out to the owners,

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Planning the End of Chlorine

By David Moberg

Introduction

Phasing out the use of chlorine is likely to be one of the major environmental issues of the next decades. Both evidence of chlorine's harmful effects and citizen opposition to chlorine-based toxic chemicals have been mounting rapidly. Any transition from chlorine, however, will create economic disruptions that could generate political opposition to this process. Yet such a transition could also create new economic opportunities. The outcome depends heavily on what public policies governments adopt and how active a role they are willing and able to play.

The battle over chlorine, which has been building for several years in the Great Lakes region and in Europe, is gaining a higher national profile. In February the Environmental Protection Agency proposed a study of how to reduce, prohibit or find alternatives for chlorine compounds, leading to formulation of an action plan within two and one-half years. Though the administration is already backpedaling on the significance of this proposal, many environmental and public health groups and several international conventions of governments from major industrial countries have forcefully called for a chlorine ban.

Industry is attacking the scientific and regulatory arguments for a chlorine ban, no matter how gradual the phase-out. It is also claiming that chlorine is essential and irreplaceable for our way of life and that a ban would pose immense costs in lost jobs and economic output. It is true that a ban will require a major transformation of many American industries and will have profound implications for workers, communities and businesses, especially in industrial areas like the Great Lakes region. This poses a challenge for environmentalists, unions, local governments and many others of how best to handle the transition.

This discussion paper will first describe the history of chlorine and public policy, then outline some of the major issues in planning a transition from chlorine. It will conclude with some observations on public policy regarding such economic changes.

Chlorine Use: History and Problems

Chlorine gas, which does not exist in nature, was first produced roughly a century ago by passing an electric current through salt water. That electrolysis generates chlorine and sodium hydroxide, a caustic material used in many industrial applications. Chlorine can form thousands of compounds with carbon. These compounds, called organochlorines, have various significant qualities, such as being very stable (plastics) or being toxic.

Over the past half-century, chlorine and organochlorine chemicals have grown dramatically in importance in the chemical-industrial complex. More than 11,000 chlorine compounds are manufactured; they are important as bleaches (especially in making paper), solvents and cleaners, disinfectants, pesticides, plastics, and as intermediate chemicals in producing many other products. **Chlorine-dependent industries account for about $72 billion in annual sales and employ about 367,000 workers in the United States, according to industry estimates.**

Health Problems

Evidence is growing that certain chlorine compounds are responsible for a wide range of serious health and environmental problems. Moreover, many of the most toxic chlorine

products are extremely persistent in the environment. When some of the stable compounds ultimately break down, they often form new toxic compounds rather than innocuous by-products. Indeed, thousands of organochlorines are accidentally but inevitably produced during the course of manufacture, use or disposal of chlorine chemicals. These accidental chemicals include dioxins and related chemicals that are among the most toxic materials known. These persistent toxic organochlorines also accumulate in the tissues of living things, especially the fatty tissues, and become more concentrated, with magnified harmful effects, in higher reaches of the food chain. Predators, from eagles to humans, are thus especially vulnerable.

Starting more than 30 years ago certain organochlorines, such as the pesticide DDT and the widely used polychlorinated biphenyls (PCBs) were identified as harmful and their production in the United States was stopped. More recently scientists discovered that chlorofluorocarbons (CFCs) were destroying the protective ozone layer of the upper atmosphere and a worldwide agreement to phase out production was negotiated in 1987.

Uses of Chlorine

Use	Kilotons of chlorine used per year
PVC (polyvinyl chloride)	3,530
Pulp and paper	1,950
Industrial solvents	1,110
HCl (hydrochloric acid)	950
Wastewater treatment	463
Pharmaceuticals	160
Drinking water	154
Pesticides	130
Dry cleaning	72
Other	3,579
Total	**12,098**

Over the years evidence has accumulated that in many species organochlorines are linked to reproductive failures and declining populations, mutations and deformities, a generalized failure of the young to thrive, sexual abnormalities (such as a feminization of males). Organochlorines are also linked to immune system deficiencies. Many of the same problems have shown up in humans. **There is growing evidence that various organochlorines either cause or accelerate cancers; increasingly they are suspect as contributing to the increasing incidence of breast cancer. Perhaps the most worrisome evidence indicates that even very small amounts of some organochlorines in the mother's body can severely damage the development of the fetus.** That can lead not only to physical abnormalities (including smaller penises on boys whose mothers were exposed to PCBs) but also behavioral problems (such as slower learning, lessened motor and perceptual abilities, or jerky movements).

Some organochlorines appear to have their effect by mimicking hormones and inserting themselves in the internal workings of human cells. Even the presence of a few molecules of a chemical like dioxin at the wrong time and place can have dire consequences. The EPA reassessment of dioxin's dangers, which should be completed this spring, is likely to conclude that the amount of dioxin in the bodies of average Americans--not just those exposed to waste dumps, hazardous waste incinerators, chemical factories or large quantities of contaminated fish--is already a potential health risk.

Chlorine and Science Policy

The production and disposal of even the less harmful organochlorines create a wide range of highly toxic trace compounds. Also, there are great similarities in the known effects of many organochlorines. But because people and wildlife are exposed to a diverse

toxic soup of chlorine compounds in the environment it is difficult to pin the full blame on any one chemical. It would also take centuries to test thoroughly each and every organochlorine compound. Furthermore, it is impossible to know the effects from the millions of potential different interactions of toxic chemicals in the environment.

Many people argue, therefore, that organochlorines should be treated as a class, not one by one. Furthermore, they argue that public policy should be determined by "the weight of evidence" and should not await some definitive scientific proof that may never be available. Public policy should be formulated on the basis of a "precautionary principle." The burden should rest with producers of chemicals, especially those in a class that is known to be persistent and highly toxic, to prove that a chemical is safe before it is used in industry. A chemical should not be considered innocent until proven to be so. These principles lead to an approach to environmental policy that is solidly based on scientific research but recognizes the limits of science.

Research and citizen pressure led to a public policy breakthrough in 1992. The International Joint Commission (IJC), a body appointed by the United States and Canadian governments to monitor compliance with international agreements on the Great Lakes environment, concluded in its biennial report that chlorine should be eliminated as a raw material for industrial or other uses. In its latest report, released in mid-February, the IJC reaffirmed its view, arguing for the phase-out of organochlorines as a class. Over the past two years, four major international conventions and the American Public Health Association have also called for a chlorine ban.

The Costs of Saying Goodbye to Chlorine

The producers and users of chlorine chemicals are arguing that

- the dangers of organochlorines are not proven,
- the problems are confined to only a few chemicals at most,
- the industry can restrict releases into the environment to a level that won't be harmful.

Although these arguments are important to the politics of phasing out chlorine, they can be persuasively countered. Let us concern ourselves with a different question. Can it be done--and without serious damage to the economy, to workers and communities?

Perhaps cost should not enter into the debate, when the future well-being of generations of humans and much of nature is at stake, but inevitably it will be. In a limited sense, some kind of balancing may be justified. For example, if there were indeed pharmaceuticals that could only be made using chlorine, then we would be justified in weighing the lives saved with the drugs against the lives lost from chlorine production. However, most cost-benefit analyses are pseudo-scientific exercises that provide information of limited value but can be easily manipulated. The costs fall on obvious and often powerful interests and are often exaggerated. Benefits are often hard to quantify or even to identify with complete certainty and they may accrue to future generations.

In thinking about these issues, there are two distinct areas for analysis and action: **direct production** of organochlorine chemical feedstocks and the **uses** of chlorine compounds in pesticides, pipes and other products. Costs and advantages fall on different people and places depending on the area of focus.

There are in fact alternatives to chlorine for most uses. In some cases, they may prove to be at least as cost-efficient even without taking into account "externalities" such as chlorine's damage to the environment and human health. Indeed, the chemical industry recently funded research by Charles River Associates (CRA) that demonstrated one of the environmentalists' points: it is possible to find substitutes for virtually all current uses of

chlorine. CRA claimed however that the alternatives would cost an additional $102 billion a year for the United States and Canada plus $67 billion in investment in new technology.

But those figures are misleading. By CRA's own calculations, eliminating 95 percent of chlorine use would cost only about $20 billion annually. Their estimate for phasing out chlorine use in the pharmaceutical industry is $53.6 billion per year, more than one-half of their total. They arrive at this figure by assuming that all pharmaceuticals produced with chlorine would be banned immediately, with resulting costly increases in disease, hospital stays, and so on. A sensible phase-out program could make exceptions for specific medicines and generally could operate more efficiently and less disruptively than the chemical industry assumes. But we do not know the real costs of displacement or lower wages, nor do we know which people and which regions would win, which would lose.

Public Policy

Since so many interests are affected, the choices are too important to leave solely to "the market," but must derive from public policy, publicly arrived at. For example, left to their own devices, manufacturers of dry cleaning equipment and chemical manufacturers may prefer to find a chemical substitute for perchloroethylene ("perc"), now used in dry cleaning, rather than moving to a technique that relies more on skilled labor and soap and water (and which has shown to be better than perc in most instances). Without carrot and stick incentives, paper manufacturers may be biased towards changing from chlorine to chlorine dioxide for bleaching paper (which does create less dioxin), rather than adopting new technology that uses "closed loop" paper treatment process with little or no discharge. **While the more drastic technological change may cost more up front, in the long run it would be environmentally preferable, cheaper to operate, and economically advantageous in other ways.** In each instance, public measures could be decisive.

As a society we can decide between different approaches by examining what our goals are. For example:

- we want to maximize the environmental and health benefits.
- we want to minimize economic hardship, especially to workers and communities whose lives are disrupted.
- we want to maximize other benefits, such as creating new industries that are environmentally sustainable and provide jobs producing goods and services for workers in the United States.
- we want to satisfy as far as possible the whole range of interested parties--workers and their unions, communities, environmentalists and public health advocates, and business. These groups have different interests and different stakes in the various goals, thus conflicts between them are inevitable. One task of the policy process is to make those conflicts of interest explicit, along with the pros and cons of alternative policies to the various stakeholders.

The transition away from chlorine will be shaped primarily by public policy, although there's an important, complementary role being played by shifts in market demand--for example, for organic foods or chlorine-free paper. But there is a choice of policy mechanisms to bring about change--taxes, bans, regulatory timetables, government purchases, environmental or occupational health standards, to name a few. There's also a range of choices for how to help workers, communities and businesses adapt to both the pain of disruption and the possibilities of new products and technologies.

Before looking at some case studies of how society might move away from chlorine, it is important to note that the core producers of chlorine chemicals have very different interests than the larger number of industries that use those products. If there are alternatives and the right combination of incentives, some users may shift with limited resistance. But

the producers of products like chlorine, chlorinated solvents, pesticides and polyvinyl chloride plastics may find it difficult, if not impossible, to retool their factories. Makers of plastic chairs, however, do not have the same stake in chlorine as do makers of chlorine or polyvinyl chloride.

In the transition model for the phase-out developed by Greenpeace, the organization that has led much of the thinking and political action against chlorine, governments would not rely on only one mechanism to speed the end of chlorine. First, chlorine production would be taxed. The chlorine tax would raise prices, in theory encouraging users to find substitutes or develop alternative production techniques. Moreover, if the chemical industry reduces its electrolytic production of sodium hydroxide, it will automatically reduce the production of its by-product, chlorine. That will in turn reduce the pressure to find "sinks" in which to dump chlorine, a role now being played in large part by the polyvinyl chloride plastics business. Finally, the tax would provide a source of revenue to pay for costs of adjustment and transition.

Yet a tax is not a perfect mechanism. First, there is the risk that if the tax is too low, it will have little effect; if it is very high, it produces greater political resistance and could be more disruptive. Setting the tax right, which would include raising it over time, requires careful analysis. Greenpeace currently argues for a $100 per ton tax, which would yield about $1 billion in the first year, but it is a somewhat arbitrary first guess.

Although the tax rewards companies that shift, it does permit companies to continue using chlorine chemicals. A modest price differential might move the paper industry away from chlorine, but it could be that pesticide producers and users would persist longer. (Although even now many farmers are cutting back pesticide use for economic and health reasons, pesticides are often a small percentage of total agribusiness costs.) It is possible that multinational chemical giants will spin off their chlorine-related subsidiaries in an attempt to avoid responsibilities for the transition from chlorine. Two years ago B.F. Goodrich spun off its PVC division as a new company, Geon.

While an industry-specific tax is an attractive source of money to pay for transition costs, there is no guarantee that tax revenue and costs will match neatly. For example, if the tax works very well, a phase-out could be rapid, greatly lowering revenues and leaving the government short of funds for adjustment. Also, while an industry tax establishes the responsibility of the producers and users to clean up their businesses, it ignores the broader responsibility of all of society to help workers and communities adjust.

It is also possible to shape market demand to drive the transition from chlorine. Here government at different levels and citizen groups can play complementary roles. Governments are major consumers. For example, they buy bleached paper, polyvinyl chloride construction materials (or hospital supplies), food, water and sewage treatment, and refrigerants (cooling systems for buildings or buses, for example). Those are a few examples where a shift to chlorine-free paper, wood, metal, non-chlorinated plastics, organic food, non-chemical refrigerants, or new treatment systems could make a huge difference. A few large consumers could tip the balance in some industries, making chlorine-free paper the dominant product rather than the exception, for example.

Consumer groups can accomplish similar results with pressure on big users: German environmentalists pushed the big newsmagzine, *Der Spiegel*, to chlorine-free paper, and are now creating strong demand for alternative refrigerators that do not use chlorine or fluorine-based chemicals.

Workers and their unions can contribute to the process by demanding stricter workplace safety standards either under government regulations or their contracts. Indeed, workers have the greatest health stake in moving from chlorine because they are routinely exposed to far higher concentrations of toxic chemicals as well as the danger of accidents.

Governments, especially at the local level, can influence market demand through product standards and building codes. (Plumbers in many cities have resisted polyvinyl chloride pipe for their own reasons; environmentalists could ally with them, yet they may run into opposition from low-income housing advocates who like cheap PVC pipe.) Maintaining or expanding strict pesticide restrictions on food (such as the Delaney clause prohibiting carcinogens in processed food, which Clinton's EPA has proposed weakening) provides similar motivations. Government can reinforce consumer efforts in many areas by more effectively educating the public on health and environmental risks of many organochlorines.

Although tough regulations on disposal of toxic wastes are justified and would raise costs, they also can have the side effect of encouraging illegal disposal. Strict recycling standards that are imposed on producers, such as requiring auto manufacturers to be willing to take back and recycle all of their old cars, can also discourage use of some chlorine compounds, especially polyvinyl chloride plastics, that are extremely difficult to recycle.

These attempts to influence markets also have their limits. In many cases, chlorine and organochlorines are used in intermediate processes, so that consumers--individuals, governments or businesses--are not aware that chlorine is an issue. Therefore, research is needed to determine the most effective points to intervene in the product's life cycle, from production to disposal. Also, producers focused on short-term costs and profits often resist consumer pressure, even when producer resistance works against their own long-term interests (much as the auto companies long resisted making smaller, more economical cars).

International trade regulations compound the problem by prohibiting discrimination among imports on the basis of the processes of production, which would permit foreign or multinational producers to circumvent United States laws and continue to bring in chlorine-dependent products. Although regulations could be drafted discriminating on the basis of trace amounts of chlorine chemicals in products, often the amounts may not be detectable even though the overall impact of the process is cumulatively harmful to the environment. Government procurement policies favoring chlorine-free products might also be challenged as non-tariff barriers to trade.

Finally, governments can impose bans on certain products (as has occurred with DDT and PCBs) or set timetables for the phase-out of their use. Relying solely on such regulations, without structuring the markets to move in the same direction, would be likely to encourage resistance and be less effective. Yet markets by themselves probably will not work with sufficiently fast and sure results.

The Phase-Out: Three Examples

Let us consider how these policies designed to hasten the end of chlorine might work in three different cases--pulp and paper making, dry cleaning and plastics.

Paper: North American papermakers generally lag behind European companies, especially those in Scandinavia, in moving to totally chlorine-free (TCF) papermaking. Pulp and paper companies want a minimum of new investment and are not eager to learn new techniques. But a more drastic technological change would be better on several counts. Paper companies using ozone, oxygen or hydrogen peroxide have demonstrated that they can attain the standards of whiteness paper users demand. Furthermore, there is strong evidence that eliminating chlorine cuts chemical, energy and disposal costs dramatically, as well as avoiding future liabilities for contamination.

Also, eliminating chlorine--which is very corrosive--makes it possible to build "closed-loop" mills that recycle water used in the process. These closed-loop facilities cost less to build than traditional pulp and paper mills and provide even greater savings in chemical, water, energy and disposal costs. In addition, failure to move towards the closed-loop

technology means that American suppliers of capital equipment for the paper industry will lose world markets for their goods, as the Scandinavians and others demonstrate technological superiority as well as environmental sustainability.

Raising the cost of chlorine and chlorine dioxide through taxes would speed this process, as would setting timetables for eliminating chlorine (as Ontario and British Columbia have done in Canada). If the Clinton administration had set standards for TCF paper purchases when it recently issued guidelines for buying recycled paper, it could have further accelerated changes that should be made on both environmental and economic grounds. Federal legislation introduced by Rep. Bill Richardson would prohibit all release of chlorine compounds from paper mills within five years. State and local governments could take their own action on purchases. Where there are paper mills, they could impose their own phase-out timetables. But the political firestorm of jobs versus the environment is likely to be greatest locally.

Dry cleaning: Perchloroethylene, or "perc," is a known carcinogen that is used to wash clothes without water. The process releases dangerous quantities of perc to employees, customers and adjoining homes and businesses. Under EPA pressure, the industry is now seeking machinery that will reduce the emissions. But there are techniques--often updated versions of traditional methods--that use soap, water, spotting agents, mechanical action (scrubbing, tumbling, blowing) and other non-chemical agents to clean clothes that now are typically dry-cleaned. EPA tests showed the results of "wet cleaning" are equal to, if not better than, those of dry cleaning.

The nation's 34,000 dry cleaning establishments are mainly capital-shy small businesses, often owned by struggling immigrant or minority families. Although the EPA study suggests that new wet cleaning operations could be more profitable than dry cleaners and price-competitive, in order to make the change these small businesses need new investment and training. If a dry cleaner stays with the older techniques, increased costs of chemicals and chemical disposal as well as tightened emission requirements would increase their costs. Consequently, government may be able to move the industry away from reliance on chlorine solvents with a lighter hand.

First, it could simply ban new perc cleaning operations, perhaps followed by a timetable to phase out old perc cleaners. This could be accomplished at almost any level of government, since dry cleaners are service businesses tied to particular localities and can't easily flee. Second, the government could provide better information for both the businesses and customers. If customers are aware of the dangers of perc and the existence of alternatives, they would be a ready market for wet cleaners. If the government supports research on alternatives and demonstration projects, such as one to be operated with an EPA grant by the Center for Neighborhood Technology in Chicago, then dry cleaners will be able to learn more about the alternatives available to them.

In the transition, there is a possibility that franchises could emerge to dominate large sections of the industry. Public policy could minimize this, if protecting small business is a goal, by making sure that training in wet cleaning techniques and no- or very-low interest loans for new equipment were available to small operators. If there is any way to recycle old perc machines for other uses, besides scrap metal, that would also help overcome one of the barriers to transition for small businesses. This raises a question as to whether chains or ma-and-pa operations are socially preferable: Under which system is labor more likely to be exploited? Which system gives more opportunity to disadvantaged Americans?

PVC Plastics: Much of PVC usage is driven by a desire to dispose of the surplus of chlorine produced in the course of producing sodium hydroxide. So as other uses of chlorine decline, there may be renewed efforts to dump it into plastic. PVC uses are so diverse that

it will take many different strategies to attack its use, short of a complete "sunsetting" of chlorine. For example, hospitals may be responsive to citizen charges that their use of PVC is a public health hazard, especially when alternatives are available. Local building codes could simply prohibit use of some PVC products, such as pipe or siding, but could not prohibit PVC-coated electrical wire until changes took place at a national level.

Consumer pressure generally could be effective, since often metal, wood or other plastics are readily available as a substitute, though a consumer boycott may lack zeal since PVC products themselves pose no danger to consumers. Recycling requirements could effectively eliminate many PVC containers as they are among the least recyclable plastics.

In general, eliminating PVC is likely to cost mainly the jobs of the vinyl manufacturers themselves, although some processors may not be able to shift to another material. There is likely to be a shift of jobs to producers of aluminum, steel, wood or fabric, or among fabricators, but the disruption in most communities should be minimal. In most cases, government would need to provide only modest amounts of training, credit or technological know-how to permit a smooth transition. Research on alternatives may also be helpful.

The Transition and Its Effects

From these examples, it is obvious that there will be quite varied effects on workers and communities as a result of a phase-out of chlorine. Overall, *with planning and sufficient additional capital*, the net job effects of eliminating chlorine could be zero or positive, leaving aside for a moment the people who produce chlorine itself. For example, shifting to wet cleaning could lead to a 20 percent increase in jobs and higher wages as skilled labor replaces capital-intensive equipment. Organic farming is likely to require slightly more skilled labor and less capital than chemically intensive farming, although farmers may need technical assistance and temporary financial sup port during the change of methods.

The workers in the core chemical industries, where jobs surely will be lost, require special consideration. In many cases, they work in medium-sized cities, like Midland, Michigan; Niagara Falls, New York; or Sarnia, Ontario. They are now skilled and well-paid. If they lose their jobs, there will be few opportunities in their communities for comparable work or perhaps any work.

In many industries that use chlorine chemicals, some retraining would be necessary to ease the transition. Also, much of the work could remain in the same community--assembling cars with unchlorinated solvents, building houses with wood siding rather than plastic, working in chlorine-free hospitals.

A speedy transition can give American firms an advantage in supplying a rapidly growing domestic and worldwide market for chlorine-free products and for developing those new production technologies to sell to other countries. Many businesses will find that their costs--for chemicals, disposal, liabilities and more--will actually decline. To the extent that new investment is needed, the transition from chlorine can accelerate modernization that can also take advantage of other improvements to increase efficiency, reduce energy consumption and make businesses more competitive. The more comprehensive the planning, the greater the potential benefits.

There will be other potential gains, some of which can be realized only over many years, especially since organochlorine pollution will continue to be a serious problem for many decades after all chlorine production stops. According to estimates by the International Joint Commission, the health effects of organochlorines cost the United States more than $50 billion a year. Elimination of organochlorines could also reduce pollution control and disposal costs of $20 to $40 billion a year. It could also reduce the environmental enforcement burdens on state and local governments, as well as poten-

tially $20 to $100 billion in private and public costs over two decades for cleaning up new toxic waste sites.

Consequently, advocates of a ban on chlorine can argue that despite the costs and disruptions, there are tremendous economic gains available if industry cooperates and makes the most of the change rather than fighting it. They can appear to be on the side of future-oriented "winners," rather than being identified with "losers" left behind by a changing world. Yet the industry can mobilize fear of change. It will pick the most beneficial uses of chlorine--disinfecting water and making pharmaceuticals--and warn that a chlorine ban will bring disease and misery. Advocates of chlorine conversion thus must be willing to make exceptions for such small but critical uses until adequate substitutes are demonstrated. This is safe to do because there are likely to be reasonable alternatives and the amounts of chlorine involved in critical public health products are relatively small.

Policy Alternatives: What should be done?

As noted above, the participants in this transition will have different or conflicting interests. Some workers will fear job loss and oppose the change, much as happened with loggers in the Pacific Northwest over old growth forests. Fortunately, the leading union in the chemical industry--the Oil, Chemical and Atomic Workers--publicly states that it does not want its members making products that harm the environment and human health. It advocates creation of a Workers' Superfund, which would protect the 30,000 or so members who would be affected by a chlorine ban plus the thousands more non-union chemical workers. Modeled on the successful GI Bill, the Workers' Superfund would provide four years of education with income support for displaced workers.

However, it is a mistake to think that retraining is an adequate or realistic solution in many cases. For example, the Trade Adjustment Assistance program on average led to only one out of ten workers finding a training-related job that had the potential to pay 80 percent or more of his or her previous wages. Workers, especially the older workers likely to be most affected by the ban, cannot easily move to find new employment, and the communities in which they live suffer as the job and income base shrink.

Part of the adjustment process should involve trying to locate industries in the communities that have been dependent on the core chlorine chemical producers. Since many of the chlorine chemical producers are large multinationals, they should be encouraged to locate any new investment in the communities that formerly manufactured chlorine products. But what incentives, if any, should be given for such investment? And does state or national government have the power to affect industry's decisions?

A chlorine tax fund could provide some money for local economic development, and government can give preferences for chlorine alternatives that it purchases from businesses that locate or expand in those areas. Yet there is no reason why the redevelopment of local economies that have been linked to chlorine should be tied to chlorine alternatives nor to the revenues of the chlorine fund. It may be that the best economic development strategy would pursue a completely different set of industries or institutions. In any case, the absence of a strong economy will hamper any local economic development strategy.

From the public policy viewpoint, it may make more sense to have a universal program that deals with all unemployed and displaced workers, regardless of the reason, on the same terms rather than a hit-or-miss collection of specialized programs. Current budget constraints and political conservatism mean that such general programs are likely to be at best meagerly financed. However, if community groups and labor have a prominent role in local decision-making about how to use both training and economic development funds, there is a better chance of worker interests being represented. Public policy should also encourage worker and union involvement in alternative use planning at factories that face shutdowns because of the chlorine ban. As with worker retraining, local eco-

nomic development will be most successful if it is linked to an overall economic strategy for a region or for the country.

•••

By conscious planning that does not rely solely on private-sector behavior, the transition from chlorine can be a relatively smooth process with a minimum of hardship. But that is not to say it will be easy.

[Thanks to Jack Weinberg of Greenpeace for many suggestions on managing the transition from chlorine.]

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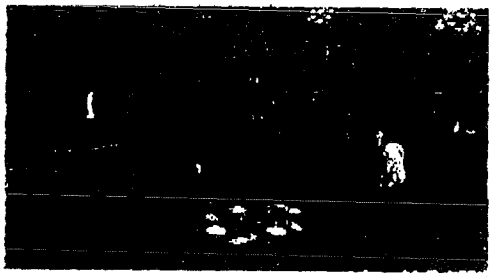

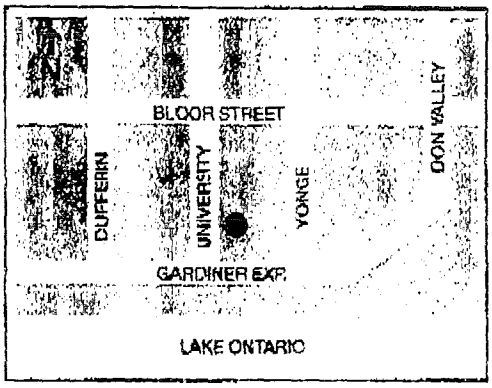

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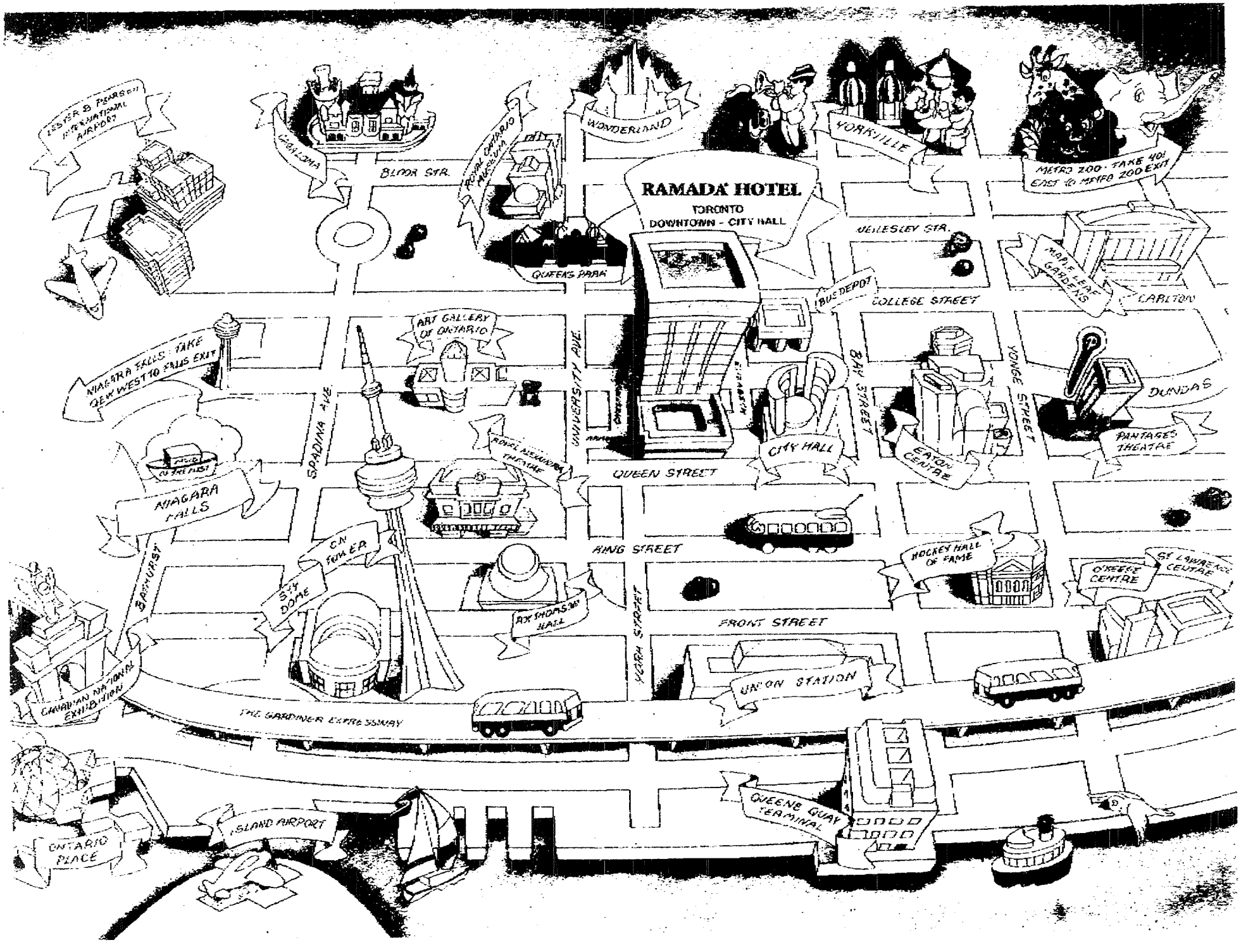
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Unions Speak to the International Joint Commission

Canadian pulp and paper workers

"Building a Sustainable, Prosperous Future—Labour Involvement and Decisionmaking Practices"

by Brian Kohler

Communications, Energy and Paperworkers Union

I would like to begin by thanking the environmental and industry groups who have made room for a presentation by labour, by giving up some of the time available to them on this agenda. The Communications, Energy and Paperworkers Union of Canada represents some 140,000 workers in key economic sectors such as the chemical, oil and gas, pulp and paper, pharmaceutical, communications, electrical and electronics industries. Many of our members are engaged in the productions and/or use of chlorine and chlorine compounds. As such we are keenly interested in the actions of the International Joint Commission on the chlorine issue.

photos by Reg Gilbert

Sustainable development requires an integrated approach to decisionmaking in society incorporating environmental, economic, and social concerns. Labour is uniquely qualified to suggest sustainable solutions to the problem of toxic substances not only because of the link between occupational and environmental health, but also because of our unique knowledge, organization, and long-standing concern for health and livelihood.

ardous. Others can be handled safely and are essential to maintaining health and prosperity. The characteristics of most chemicals lie somewhere between these extremes. The question of how we use chemicals has unfortunately attracted more sensationalism than science in recent years.

Some would like to shut down the chemical industry tomorrow, with apparently little understanding of the fact that economic and social devastation can themselves result in environmental damage. Equally wrong are those who try to trivialize concerns about the health and environmental effects of chemicals using pseudoscientific risk assessments and statistical mumbo-jumbo.

Limitations of science

Let us agree to stop arguing about whose expert is better than whose. The search for absolute scientific certainty before making a decision is usually an excuse for inaction. Labour knows from long and bitter experience that when experts disagree, it is working people who pay the price with either their livelihoods or their lives. Let us make full use scientific information but recognize that decisions will have to be made and solutions, perfect or imperfect, will have to be tried. Surely we can agree that socioeconomic needs are important to most people. It should be equally obvious that if we know that something is dirty, common sense would tell us to clean it up.

Oil, chemical and atomic workers

"An Orderly Transition in Any Chemical Sunsetting Program"

by Richard Miller

Oil, Chemical and Atomic Worker

I am speaking today on behalf of the 90,000 members of the Oil, Chemical and Atomic Workers Union in the United States, because the International Joint Commission's proposal to phase out the production of organochlorine compounds has provoked substantial interest from chemical workers.

Our message and interests are distinct from those of governments, industry and environmental advocates. We thank the environmental nongovernmental organizations and the industry groups for volunteering portions of their time to allow our participation, as the IJC rejected our request for a separate allocation of time to speak at this plenary session.

Today we will not comment on the scientific merits of the IJC's sunsetting proposal, nor engage in the debate over whether organochlorine compounds should be sunsetted on a case-by-case basis or presumptively as a class. Our union believes that if a compound which we produce poses an unacceptable danger to the environment or public health, we should be making something else. Unfortunately, our members do not control the choice of what gets made or how research and development dollars are allocated: these decisions are made exclusively by management.

can advocate the elimination of his or her job. . . . If they switched jobs they would have to cut their incomes in half and probably lose all benefits. Not many family people can afford to do that.

Some environmentally concerned policymakers argue that we should let the free markets resolve the economic fate of dislocated workers. Other advocates have commented that these industrial jobs are being eliminated for other reasons anyhow and job loss driven by environmental regulation is comparatively inconsequential.

What these perspectives ignore is that the very visible hand of government regulation is dictating that certain jobs and processes will be eliminated. While battles with the "invisible hand" of the markets are more elusive, workers can see and fight back against the more visible hand of regulation that could cause dislocation.

Other policymakers suggest that existing social safety net programs are sufficient. In the United States, targeted assistance programs, such as the Clean Air Act's Employment Transition Assistance provisions, offer, at best, a transition to a lower-wage job. The lack of viable economic alternatives for workers has created a wide political gulf which promises to increase inequality; politically it imposes a ceiling on the kinds of

. . . paper workers

continued from previous page

Environmentalists must understand that it is the workers, first and foremost, who pay the price for the use of toxic chemicals with their health and their lives. *Employers* must acknowledge that it is the workers, much more so than shareholders, who face economic ruin when industries close. *Governments* must be reminded that it is ordinary working people whose interests they were elected to protect.

Just as workers cannot, under law, be penalized for seeking enforcement of occupational health and safety standards, so must we not be punished for supporting a cleaner environment. If specific jobs cannot be sustained, then employment must be—even if it requires a redefinition of the term "employment."

Sustainable development

Sustainable development calls for the integration of economic, social, and environmental decisionmaking. This does not simply mean that there will be economic priorities, environmental priorities, and social priorities. Rather, we will have to learn to address them simultaneously. Our decisionmaking process and the evaluation of the success or failure of our policies and programs will have to look at the impact they have had on all of these areas.

High unemployment levels have been associated with the long-term lack of a national industrial strategy on both sides of the border. Long-term damage has been done to the water quality in the Great Lakes by toxic contaminants. Lack of education and opportunity have caused social disintegration. While clearly pollution in the Great Lakes does not "cause" unemployment, and the education system does not "cause" pollution, it will be impossible to resolve any one problem without examining the others, especially if long-term solutions are desired. Sustainable development theory suggests that we should do exactly this.

Partnerships must be forged between some of the solitudes of society. We need the perspective of all stakeholders, but each stakeholder must in turn be willing to listen with respect to the concerns of others. We need the wisdom of all branches of academia, but at the moment they do not even speak the same language.

We may decide, as a whole society, that the risks associated with the manufacture of a product are outweighed by some overriding good (for example, a hypothetical cure for AIDS whose manufacturing process unavoidably generates a toxic waste). That is a far different decisionmaking process than risk assessment carried out in secret by a decisionmaking elite. Equally, if we decide, as a society, that the environmental price of continuing a chlorine industry is too high, it is fair to ask of society as a whole, "what will you do for the workers, and their communities, in return?" If we are not willing to discuss these issues, or shrug and say "it is someone else's problem," then I think we do not have the moral right to make these kinds of decisions.

Solutions

example, require their own regulatory framework in order to function, and voluntary actions, in the face of the threat of regulation, have been effective in protecting the environment. There is nothing about a deregulated free marked economy that ensures environmental protection. Neither does a heavily regulated industry guarantee good environmental performance, as demonstrated by the former Soviet Union and eastern European countries. We must be willing to use every tool at our disposal if we are to tackle these problems.

The simple act of listing chemicals that are toxic, bioaccumulative, and persistent creates the false impression that solutions are as simple as crossing items off a list. A more realistic prioritization attempt would consider the negative health and environmental effects of chemicals as being part of a decisionmaking matrix that includes social value, economic impact, extent of exposure and ease of substitution, etc.

Protection for environmentally displaced workers must be discussed at the same time as proposed regulatory action. These are not separate issues but are fundamentally interlinked and basic to the acceptability of any other solutions.

Decisionmaking practices

Our present decisionmaking practices tend to be fragmented. We like to take one piece of the problem at a time. A consequence of that system is that the initial decision tends to get eroded or compromised in the subsequent decisions. This fuels the determination of concerned individuals and groups to demand that the initial decision be as extreme as possible. Consider a list of chemicals chosen as candidates for phase-out based only on biophysical criteria. If socioeconomic considerations are only factored in later, the list can only be shortened, leaving us vulnerable to criticism from those who may feel that a "sell out" has taken place each time a chemical is deleted or reduced in priority.

However, a truly integrated decisionmaking process would allow the possibility of socioeconomic considerations not just lowering, but on occasion raising, the priority of a substance. It bears repeating that sustainable prosperity will be achieved only if decisions integrate the concerns of all stakeholders and the wisdom of diverse disciplines into the decisionmaking process.

Conclusion

When will we start to build a sustainable, prosperous future?

- When we recognize the distinction between a legitimate difference of opinion and a simple lack of information;
- When we realize that important social, economic, and environmental concerns cannot be simply wished away;
- When we really try to change the way decisions are made.

Workplace disease and death need not be the inevitable consequences of modern industrial production. Neither should environmental disaster be considered inevitable. None of us should ever com-

. . . chemical workers

continued from previous page

back to the end of World War II. At that time the U.S. economy converted from a full-scale wartime economy to a peacetime economy. There were 14 million soldiers to employ, and not nearly enough jobs to go around. To avoid massive unemployment and a return to the Great Depression that gripped the nation before World War II, servicemen (but not women) were offered up to four years education with income support under the Serviceman's Readjustment Act of 1944, also known as the GI Bill of Rights. Work was redefined: workers were paid to go to school while the economy shifted its productive capacities.

The United States Congress Joint Economic Committee estimated that for every dollar invested in the GI's higher education, the government and economy received $6.90 in return (in constant dollars).

Borrowing from the GI Bill of Rights, OCAW has proposed a Workers' Superfund—full pay and benefits and tuition for any workers losing their job for environmental, trade, or other socially driven reasons—as an alternative to unemployment, welfare or poverty.

We propose "redefined work": guaranteed annual wage coupled with education—in acknowledgment that there may not be enough jobs for workers who go through a "retraining" program. With the opportunity to participate in a new economy where knowledge-intensive vocations will replace energy- and toxics-intensive production, workers will not be forced into dead-end jobs flipping burgers under the golden arches—while their bosses wind up with golden parachutes.

With full income, the conflict between jobs and environment will end. This proposal does not attempt to solve all of the questions surrounding conversion and diversification of industries. Rather it addresses the often overlooked question of equity: who will shoulder the social costs of dislocation from the coming environmental transition.

Principles for orderly transitions

We believe that the sunsetting of chemicals, if it proves scientifically necessary, can be built upon a bedrock of equity and fairness. Below we set forth some suggestions for a framework that might be utilized if chemical sunsetting goes forward in the future. Our suggestions are geared to consistency with national and international precedents and with the following principles:

- Any transitional program would promote orderly transitions by its choice of mechanisms, timing and clear prioritization of goals.
- Economic incentives, with their potential for greater efficiency, may be preferable to command and control regulations, so long as workers and communities are not made de facto victims of such a program.
- A transitional program should promote "sustainable development," by which we mean it should be consistent with a shift in the way we think and act regarding work and income, economic growth and social welfare, society and nature.
- Workers who are displaced from sunsetting organochlorines should suffer no net loss of income.
- A firm that ceases production of targeted compounds, but on a local level preserves or expands jobs comparable to those eliminated, should not be required to pay for the transition adjustment costs of other firms . . .

Potential program elements

In brief, the program we propose would entail the following elements:

- Establishment of an international fund and administering agency.
- Collection of fund monies from individual producers of substances targeted for elimination.
- Determination and designation by administering agency of workforces affected by chemical sunsetting.
- Distribution of nonrepayable transitional assistance funds for workers and producers affected by the chemical sunsetting.
- Availability of low- or no-interest loans.
- Availability of technology assistance.
- Cap on administrative costs and eventual sunsetting of fund.
- A multistakeholder process for developing and overseeing the worker and facility transition program.

[With respect to technical assistance] Some of the relevant international precedents for this program include the United Nations International Cleaner Production Information Clearinghouse, which makes available information on technologies for pollution prevention, and the Montreal Protocol Multilateral Fund and Global Environmental Facility, both funding technology transfer assistance for developing countries . . .

There are numerous institutions in the United States and Canada which provide a potential home for such research and technical support. Examples of university-based programs in the United States within the Great Lakes Basin include the Ohio Technology Transfer Organization, a group of 28 technical colleges in Ohio which provide pollution prevention technical assistance to small and medium sized industries; New York State Center for Waste Management, which works with universities and colleges in New York State to help promote technology transfer for waste reduction, and Michigan State University, which has a program for waste reduction assessment training for business, government and nonprofit organizations.

Some noteworthy programs outside of the Great Lakes Basin that focus more specifically on toxics use reduction rather than waste minimization are the Toxics Use Reduction Institute at University of Massachusetts, Lowell, which

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with its knowledge, history, and organizational strength, is certain to play an

Table 2
The Evolution of Approaches to Persistent Toxic Substances

	I →	II →	III
	CONTROLLING RELEASES	**PREVENTING USE OR GENERATION**	**TOWARD SUSTAINABLE INDUSTRY AND PRODUCT/MATERIAL USE**
Focus	Release	Chemical use/generation	Materials
Policy	Control abatement technologies (Control technology change)	Use reduction Process/product changes (Process change)	Source/use profile (Use tree and life cycle concepts, industrial sector change)
Goal	Reductions in emissions levels Pollution control (acceptable levels)	Zero discharge/ sunsetting of targeted chemical Pollution prevention (clean production)	Zero production/use of certain elements/compounds Sustainable industry (Materials evaluation)

To date, neither government nor industry has been able to fully implement a pollution prevention approach. While some progress has been made, most programs tend to be media specific and fragmented compared to the need for comprehensive, integrated approaches (see Chapter 6). By one estimate (23), only 11% of United States companies filing reports under the Toxic Release Inventory were voluntarily using pollution prevention.

Phase III: Toward Sustainable Industry and Product/Material Use

In addition to implementing a prevention approach, inputs to industrial processes and societal practices need to be examined. This broader and much longer term approach involves an evaluation of the materials used in production processes and questioning the environmental appropriateness of those materials and the products.

This product/materials use notion raises many questions. In the present context the use of certain materials has the potential to result in the generation, use, or release of persistent toxic substances. Product/materials use makes us ask how and why we produce, use, transform, consume, and dispose of materials and products. This approach requires such questions as: Is it possible to eliminate the release of mercury when coal is burned to generate electricity?

The product/materials use approach not only asks what are sustainable and non-polluting production processes (as in Phase II), but also examines the benefits and negatives of entire industrial sectors, the building blocks of production, and various types of social activities. The goal of this approach is to move to sustainable societal activities and industries. This is where the development of a long-term virtual elimination strategy must start. Aids for understanding this framework include the use tree and the life cycle approach, discussed in more detail below.

3.5 PRINCIPLES OF THE VIRTUAL ELIMINATION STRATEGY

The unique properties of persistent toxic substances, coupled with the limitations of present practices and the evolution of strategic thinking, as described above, led the Task Force to articulate a set of principles that must guide a virtual elimination strategy focused on persistent toxic substances. The major principles that underlie the goals, objectives, and implementation of that strategy are **anticipation and prevention** and **remediation, treatment, and control.**

Anticipation and Prevention

Anticipation and prevention of pollution must be adopted for all substances that meet the criteria to be a persistent toxic substance. The virtual elimination strategy applies to all persistent toxic substances. All are presumed to be candidates for phaseout (sunsetting), particularly those with high bioaccumulation potential (see Chapter 4), unless data are available to

Transition Planning for the Chlorine Phase-Out

Economic Benefits, Costs, and Opportunities

A Chlorine-Free White Paper

by Joe Thornton and Jack Weinberg

February 1994

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CONTENTS

SUMMARY

The purpose of this document is to show that society can realize significant economic gains in the transition to a chlorine-free economy, if the process is guided by careful planning to minimize costs, maximize benefits, and insure that both are distributed equitably.

The chlorine industry has argued that phasing-out chlorine will result in exorbitant costs to the U.S. and Canadian economies and massive job losses. The industry's scenario, however, is based upon invalid assumptions that drastically overestimate the costs and underestimate the benefits of a well-planned transition.

The industry's calculations are based upon a methodology that assumes the chlorine phase-out will be implemented instantaneously, without thought, planning, or prioritization. The industry assumes that the alternatives that will replace chlorine will be processes that perform poorly, are unreasonably expensive, or are not the cost-effective substitutes the market would select: in fact, chlorine-free alternatives are frequently more efficient and productive than the chlorine-based processes they replace. Finally, the industry's scenario looks only at costs and burdens and fails to explore the benefits and savings associated with the transition to a chlorine-free economy. The actual costs of phasing-out chlorine are likely to be only a small fraction of those calculated by the industry, and the benefits of the transition are expected to outweigh these costs.

Implemented with careful planning, the transition to a chlorine-free economy can be economically beneficial and socially just. It can save money and create new jobs. Further, it can provide a model for how to undertake major economic change -- especially that driven by an environmental imperative -- in a way that is humane and equitable for those most directly affected.

A complete estimate of the economic benefits of the transition is beyond the scope of this document. Even the following preliminary information, however, makes clear that the net savings associated with a chlorine phase-out would outweigh the costs of a well-planned transition.

- By prioritizing major chlorine use-sectors, the cost of the phase-out can be substantially reduced. Even according to the industry's own inflated cost estimates, 97 percent of chlorine use could be phased-out for just $22 billion per year. These costs are much lower than the savings associated with phasing-out chlorine, with initial estimates beginning at $80 to $160 billion annually, as detailed below;
- Current health care costs associated with the effects of persistent organochlorines in the U.S. and Ontario have been estimated at $50 to $100 billion per year, according to the International Joint Commission on the Great Lakes. These costs to societies would be saved if chlorine were phased-out.

- In the pulp and paper industry, converting to totally-chlorine free bleaching process would save the industry $185 - 370 million per year in chemical costs; $108 to 189 million per year in energy costs, according to industry estimates; and additional millions or billions in reduced expenditures for water use, effluent treatment, disposal of contaminated sludge; and reduced costs for lawsuits, remediation, and liability.

  Mills that adopt chlorine-free bleaching process can realize additional cost savings by installing a closed-loop system for chemicals and effluents. Such a system can be built for $40 million less capital than a conventional mill; if all U.S. and Canadian mills built such systems, savings on water, energy, and chemical costs would total $1.4 billion per year.

  As the international paper market increasingly demands chlorine-free paper, European producers are converting their production processes to meet this demand. Industry analysts have noted that if the North American industry continues to refuse to change to meet a changing market, it will be left permanently behind with lower market share; revenues and jobs will be jeopardized.

- In dry cleaning, a recent U.S. EPA report shows that chlorine-based solvents can be replaced with a water-based system that is equally effective and results in a 42 percent lower capital investment to install, a 78 percent better return on investment, a 5 percent increase in profits, and a 21 percent increase in jobs. Implemented throughout the U.S., this system would create 33,170 new jobs with wages of $606 million per year.

- Manufacturing industries can replace chlorinated solvents with cleaner production processes that have been shown to result in large savings -- as much as several million dollars per company -- due to reduced costs for chemical procurement, control, and disposal. Often these processes also substitute new jobs for chemicals.

- Even in the pharmaceutical industry, the majority of organochlorines could be easily eliminated in favor of existing safer alternatives. In this sector, most organochlorines are used as manufacturing process aids -- i.e., solvents, extractants, and intermediates -- that do not appear in the final medicine. Studies by industry and by the Metropolitan Water District of Southern California have found that effective alternatives are available now to replace these organochlorines.

- Alternative agricultural systems that reduce or eliminate pesticide use have been shown to increase crop yields, lower farmers' costs, increase financial returns, and create new jobs by substituting labor for chemicals, according to the National Academy of Sciences. Estimated cost savings associated with the chlorine phase-out in this sector are up to $8 billion per year in the U.S. and Canada.

- About half of the jobs associated with chlorine are in the fabrication of PVC plastic products. Because flooring, toys, pipes, and other such products will continue to be

made when chlorine is phased-out -- but simply with traditional materials or non-chlorinated plastics -- no net reduction in jobs is expected in this large sector.

For workers producing the feedstocks or resins for these plastics, growth in production of the alternative materials -- frequently in the same facilities or regions -- are expected to offset reductions in the PVC sector. Because there may be some job displacement in this area, however, careful transition planning is necessary to insure that new investment, job creation, and assistance funds are targeted specifically to minimize the dislocation.

- Phasing-out chlorine and organochlorines will substantially reduce industry's costs for pollution control and disposal, which can represent a major drag on the economy. Estimated savings from the chlorine phase-out in this sector are estimated at $22 billion to $43 billion per year, based on U.S. EPA figures, using a very conservative estimate.
- Phasing-out chlorine will prevent the continuation of a legacy of contaminated sites with clean-up costs estimated at up to $1 trillion. Preventing organochlorine discharges that would occur over a 20-year period are estimated to result in $20 to $100 billion in obviated remediation costs.
- The transition to a chlorine-free economy would require an investment in new construction and new technologies that would provide a powerful economic stimulus. Based on the chemical industry's estimate of this investment at $67 billion, the transition would create about 925,000 job-years of new employment, or 92,500 permanent jobs over a ten-year period.

In order to insure an effective transition, the chlorine phase-out should include the following steps:

1. ***Priority phase-out sectors.*** Timelines should be immediately set for the phase-out of chlorine in the following large sectors for which alternatives have been proven effective and affordable: pulp and paper, solvents and dry cleaning, PVC, and pesticides. These sectors account for about 55 percent of all chlorine used in the U.S. and Canada.

2. ***Secondary sectors.*** Timelines to sunset other uses should be established based on the quantity of chlorine used and the availability of alternatives. Special attention should be paid to the following sizable sectors for which alternatives are feasible: chlorinated intermediates used to produce isocyanates and propylene oxide; chlorine used to produce titanium dioxide; and chlorine used in wastewater disinfection. Together with the priority sectors, these uses consume 68 percent of all chlorine now produced.

3. ***Chlorine tax.*** The U.S. and Canada should institute a tax on the chlor-alkali process and on off-shore imports of chlorine-containing products and alkali produced

through the chlor-alkali process. Chlor-alkali plants should no longer be allowed to purchase government subsidized electric power, to purchase regulated electric power at less than average market rates.

4. ***Transition Fund to protect workers and communities.*** Revenues equal to those generated by the chlorine tax should be held in a fund to aid the transition to a chlorine-free industrial society. In particular, the fund should be used for exploring and demonstrating economically viable alternatives and for easing dislocations among affected workers and communities -- particularly those associated with the chemical manufacturing industry itself. Funds should be targeted so that investment in cleaner production processes is concentrated in locations where chlorine-based processes have been phased-out, so that new jobs are created where old jobs are eliminated. Funds should also be used to insure income protection, health care coverage, and educational opportunities for workers whose jobs are eliminated in the transition. A board should be established to help set the policy of the fund and should include representatives of the various stakeholder groups.

By admitting that alternatives are available for all major chlorine uses, the chemical industry validates the feasibility of a society without chlorine. By raising the specter of job loss and economic dislocation, the industry declares itself concerned with the interests of chlorine workers, users, and communities where facilities are located.

With this declaration of concern, the chlorine industry opens up a new debate about the most effective and equitable way to implement the transition. With a careful planning process, the transition to a chlorine-free future can provide a model for truly sustainable development, and all the environmental, economic, and social benefits that accompany it.

BACKGROUND

GLOBAL CALLS TO PHASE-OUT CHLORINE

In 1992, the International Joint Commission on the Great Lakes (IJC) recommended that the U.S. and Canadian governments begin a timed and consultative process to phase-out chlorine and chlorine-containing chemicals due to the hazard this class of compounds poses to the environment and human health. Charged under the Great Lakes Water Quality Agreement with achieving Zero Discharge of persistent toxic substances, the IJC found that organochlorines dominated its critical and secondary lists of persistent pollutants in the Great Lakes, were primary contributors to the epidemic health effects apparent in more than a dozen Great Lakes species, including humans. The IJC thus placed top priority on this class of compounds.

Following the recommendations of its Science Advisory Board and its Virtual Elimination Task Force, the IJC concluded in its Sixth Biennial that it is prudent and reasonable to treat organochlorines as a class, since its members tend to be persistent, bioaccumulative and/or toxic. Moreover, the IJC found that it is not practical to regulate the thousands of organochlorines produced by industry on a substance-by-substance basis. Thus the IJC recommended that organochlorines be sunset as a class and that the sources of these compounds -- industrial processes that use chlorine and organochlorines as feedstocks -- be subject to a timed phased-out.

Since that time, a growing group of scientists, environmental organizations, communities, and other international fora have made similar recommendations. In 1992, the Paris Commission on the North Atlantic -- a ministerial level meeting of 15 European governments and the European Community -- agreed to eliminate all discharges of substances that are toxic, persistent, and liable to bioaccumulate -- "particularly organohalogens." The parties agreed "to adopt further measures for the prohibition of the use of organohalogen substances which are unnecessary for the intended use or process, and do not therefore need to be substituted for, and to compile a list of processes and substances which are suitable for substitutes."

On October 15, 1993 -- less than one week prior to the IJC's Seventh Biennial meeting, the 21 nations party to the Barcelona Convention on the Mediterranean also called for an organohalogen phase-out. The parties agreed:

> *"To recommend that the Contracting Parties reduce and phase-out by the year 2005 inputs to the marine environment of toxic, persistent, and bioaccumulative substances ...., in particular organohalogen compounds having those characteristics. In this framework, high priority is to be given to both diffuse sources and industrial sectors which are sources of organohalogen inputs."*

On October 29, 1993, the American Public Health Association, the nation's premeir organization of public health professionals, concluded that chlorinated compounds "are found to pose health risks involving the workplace, consumer products, and the general environment." The APHA recognized that "the elimination of chlorine and/or chlorinated organic compounds from certain manufacturing processes, products, and uses may be the most cost-effective and health protective way to reduce health and environmental exposures to chlorinated organic compounds" and recommended that the class of chlorinated organics be presumed harmful and phased out unless proven safe or essential.

Following these recommendations, action has been proposed to address chlorine and organochlorine pollution in U.S. national policy. On February 1, 1994, the White House released "President Clinton's Proposal for the Clean Water Act." Noting that "certain pollutants have been linked not only to cancer but also to neurological, reproductive, developmental, and immunological adverse effects," the White House called for a "national strategy for substituting, reducing, or prohibiting the use of chlorine and chlorinated compounds." Expressing particular concern about the use of these chemicals in plastics, pulp and paper, solvents, and water treatment, the President proposed an 18-month study of these issues, followed by a national strategy to address them.

Also this year, Representatives Richardson (D-NM) and Waxman (D-CA) introduced the Chlorine Zero Discharge Act of 1994 (HR 2898), which would require the phase-out of chlorine and chlorinated bleaches in the paper industry within 5 years and would initiate research and planning activities to address other uses of chlorine. At this time, both the Chlorine Zero Discharge Act and the Clinton Chlorine Strategy are awaiting Congressional action.

INDUSTRY'S RESPONSE: PUBLIC HYSTERIA, PRIVATE PLANNING

Upon release of the IJC's Sixth Biennial, U.S. and Canadian chemical industries quickly launched a concerted effort to discredit the Commission's recommendation to phase-out chlorine. Industry's public relations budget for this campaign is estimated at $5 million. When the White House released its Clean Water Act proposal, the Chemical Manufacturers' Association reacted with "outrage" and called for "a full court press" to sink the entire Act if the Clinton Chlorine Initiative was part of it.

In Public, Economic Fearmongering

The chemical industry's argument focuses on the aggressive assertion that phasing out chlorine will have devastating effects upon the economies of the U.S. and Canada. In 1993, the Chlorine Institute, the North American representatives of the industry,

commissioned and released a report by Charles River Associates (CRA), an American consulting company. The CRA report asserted that the IJC recommendation would cost the U.S. and Canadian economies $102 billion (US) per year, would impact 1.4 million jobs, and would severely disrupt local and regional economies. (1)

As the IJC's Seventh Biennial Meeting approached, the industry began a series of briefings and press events around the Great Lakes region, in which chemical industry representatives argued that the "economy, which is still struggling, will suffer enormously if these recommendations go forward." Professing concern for the well-being of the nation's citizens, the industry argued that "consumers will bear the brunt of the expense ... Communities across the country would suffer the loss of tens of billions of dollars already invested in chlorine production, including the loss of hundreds of thousands of jobs." [2]

In Private, Acknowledging Change

While the industry seeks with this strategy to stir up fear and hysteria in public, chemical industry leaders admit in private that, at minimum, the majority of chlorine-based chemicals can and will be phased-out.

The chlorine industry's own economic consultants are predicting that chlorinated chemicals will be phased-out, especially those with the lowest phase-out costs. In a speech to the American Chemical Society, Charles River Associates vice president Ronald Whitfield told the industry to "shake their denial" and prepare for "sea changes" in chlorine markets.

According to Whitfield, many large chlorine uses "will be restricted," and top phase-out candidates include PVC products and the use of chlorine in pulp bleaching, chlorinated solvents, water disinfection, and agricultural chemicals. These sectors alone consume about 7.3 million tons of chlorine each year – about 54 percent of all chlorine use in the U.S. and Canada. Whitfield predicted a combination of product bans, taxes, building code changes, labeling and reporting requirements that will lead to severe reductions in use of PVC and other chlorinated products. [3]

Investing to Protect Capital

Meanwhile, major chemical companies have begun to protect their own financial interests by investing in alternatives to chlorine. For example:

- DuPont Chemicals is working to eliminate chlorine from its chemical synthesis processes. Leo Manzer, associate director of DuPont's central science and engineering laboratory, told another recent Chemical Society meeting that although "hazardous and toxic materials" have been important reagents in the chemical

industry to date -- including chlorine, hydrochloric acid, the chlorinated intermediate phosgene, and others -- "future business practices must avoid or minimize the inventory and transportation of these materials."

DuPont has developed a way to produce isocyanates without phosgene. At present, six percent of all chlorine in North America is used to produce isocyanates, which serve as intermediates in the production of chlorine-free plastics and other products. "This trend ... is clearly the way of the future," Manzer said. [4]

- Monsanto, another important manufacturer of chlorinated and other chemicals, is also working to eliminate chlorine from its processes. Michael Stern, corporate research fellow at Monsanto, told the same conference that his company had developed "several promising advances ... that avoid the use of halogenated compounds, including chlorine," as well as chlorinated benzenes and phosgene in the manufacture of rubber chemicals, plastics, and synthetic fibers. [5]

- Dow Chemical, the world's largest chlorine producer, has begun to produce chlorine-free plastics to replace PVC. Dow has begun to invest heavily in retrofitting its plastics plants to produce chlorine-free polyolefins using new "Insite metallocene catalysis technology." According to Anthony Carbone, head of Dow's global plastics group, "Plastics have been replacing traditional materials, and now we'll go into applications where other plastic materials are used. Insite will replace PVCs, elastomers, and in some cases, engineering thermoplastics," Carbone said. [6]

- While some companies position themselves to take advantage of opportunities, others move to cut losses. Until recently, B.F. Goodrich, the chemicals and aerospace giant, was one of the world's largest producers of PVC plastic resins. Seeing the handwriting on the wall, Goodrich took steps to minimize its exposure and liability in this declining business. Last April, B.F. Goodrich spun off its PVC division, sold half of its interest, and created an independent publicly-traded company called GEON with headquarters in Cleveland, Ohio.

The chemical industry is aware that society will not much longer endure the damage to health and the environment from persistent toxic pollution. Chemical industry executives understand that there will be growing pressure to eliminate the sources. The important issue facing both these corporations and the larger society is not WHETHER these changes will occur, but HOW.

INDUSTRY'S INFLATED COST ESTIMATES

The estimates of the costs of phasing out chlorine presented in the CRA report are far from valid. These figures drastically overestimate the actual costs that would be associated with a well-planned transition. In fact, the study's well-publicized quantitative conclusions are based on the wild assumption that the transition to a chlorine-free economy will occur instantaneously by bureaucratic fiat, without any intelligent thought or planning. First, although CRA projects that costs will continue over a 20-year period, it assumes that all chlorine use sectors will be phased-out instantly and simultaneously. Second, the alternatives to chlorine that CRA considers are frequently ones that perform poorly, that are unreasonably expensive, or are not those the marketplace would select. Finally, the CRA report looks only at costs and burdens and fails to explore or identify the potential benefits and savings associated with the chlorine-free transition.

Significantly, the CRA report does admit that alternatives are available for all uses of chlorine. Its summary concludes, "The transition to a chlorine-free economy would take 10 to 20 years, during which time prices for existing products would likely be significantly higher than today." The report thus validates the feasibility of a society without chlorine and begins a new debate about the best way to implement the transition.

There is little doubt that the transition to a chlorine-free economy will take at least a decade to complete. As CRA points out, chlorine and organochlorines are used in a large number of industry sectors throughout the economy. The phase-out will require careful planning and should be carried out through a timed process that prioritizes those major sectors that can and should be phased out first.

Prioritizing will lower costs.

A few use sectors that use very little chlorine account for a disproportionately large percentage of CRA's estimated cost of the chlorine phase-out. The bulk of chlorine used in industry can be phased-out for a much lower price. If the transition plan prioritizes for phase-out those use sectors with the most affordable alternatives, a near-complete transition can take place at much lower cost.

For instance, of the $102 billion annual price tag CRA predicts, over one-half -- or 53.6 billion U.S. dollars -- is projected to come from a single industrial sector: pharmaceuticals. According to CRA's estimate, phasing out chlorine in this sector is estimated to cost $335,000 per year for every ton of chlorine, while all the other sectors combined carry a price tag about one hundred times lower. The per-ton sunset costs associated with some large use sectors -- such as chlorinated solvents -- are less than 1/2,000 of that for pharmaceuticals.

COST OF PHASING OUT CHLORINE, BY SECTOR

Prioritized by Affordability of Alternatives

	Sector	Chlorine used (kt/yr)	Cost of phase-out ($million/yr)	Cost ($/ton)	Sum Cl2 use	Sum cost of phase-out ($million/yr)	Sum cost/ton	% of Cl2 use	Sum % of Cl2
1	Industrial solvents	1,110	$180	$162	1,110	$180	$162	9.2	9.2
2	Propylene oxide	930	$190	$204	2,040	$370	$181	7.7	16.9
3	HCl - other than steel	690	$160	$232	2,730	$530	$194	5.7	22.6
4	Isocyanates	710	$380	$535	3,440	$910	$265	5.9	28.4
5	Epichlorohydrin	620	$480	$774	4,060	$1,390	$342	5.1	33.6
6	HCl - steel industry	260	$300	$1,154	4,320	$1,690	$391	2.1	35.7
7	Pulp and paper	1,950	$2,360	$1,210	6,270	$4,050	$646	16.1	51.8
8	Titanium dioxide	330	$480	$1,455	6,600	$4,530	$686	2.7	54.6
9	Flame retardants	100	$180	$1,800	6,700	$4,710	$703	0.8	55.4
10	PVC	3,530	$6,891	$1,952	10,230	$11,601	$1,134	29.2	84.6
11	Chlorinated polyolefins	60	$120	$2,000	10,290	$11,721	$1,139	0.5	85.1
12	Neoprene	140	$380	$2,714	10,430	$12,101	$1,160	1.2	86.2
13	Hypochlorites	280	$800	$2,857	10,710	$12,901	$1,205	2.3	88.5
14	Polycarbonates	80	$250	$3,125	10,790	$13,151	$1,219	0.7	89.2
15	Fluoropolymers	70	$240	$3,429	10,860	$13,391	$1,233	0.6	89.8
16	PVDC	50	$180	$3,600	10,910	$13,571	$1,244	0.4	90.2
17	Refrigerants	150	$550	$3,667	11,060	$14,121	$1,277	1.2	91.4
18	Wastewater treatment	463	$2,500	$5,400	11,523	$16,621	$1,442	3.8	95.2
19	Extractants	29	$290	$10,000	11,552	$16,911	$1,464	0.2	95.5
20	Dry cleaning	72	$880	$12,222	11,624	$17,791	$1,531	0.6	96.1
21	Silicones	30	$530	$17,667	11,654	$18,321	$1,572	0.2	96.3
22	Drinking water	154	$3,500	$22,727	11,808	$21,821	$1,848	1.3	97.6
23	Pesticides	130	$24,300	$186,923	11,938	$46,121	$3,863	1.1	98.7
24	Pharmaceuticals	160	$53,600	$335,000	12,098	$99,721	$8,243	1.3	100.0
	TOTAL	12,098	$99,721	$8,243					

Table shows the cost of phasing out chlorine on a sector by sector basis, beginning with the least costly to convert, and progressing to the most expensive (measured as cost of conversion per ton of chlorine used).

Sectors appear in order of increasing cost of phase-out per ton of chlorine used.
"Sum" columns present data for incremental cost of phase-out as each sector is added to the previous ones.
Numbers at far left refer to marker labels on graph

Data source: Charles River Associates, 1993

Many of the pharmaceuticals now made with chlorine could be made through chlorine-free processes. Still, some essential medicines are organochlorines -- precisely because these compounds are so biologically active.

Any real world chlorine phase-out program would certainly make exceptions for essential medicines that could be synthesized in no other way. The CRA report, however, makes the absurd assumption that all pharmaceuticals now produced with chlorine would be banned and removed from the market. On the assumption that most essential medicines now in used would be banned, the CRA concludes that diseases would become more debilitating, hospital stays would be longer, doctor bills would be higher, disabilities would be greater, and so forth. Based on this far-fetched chain of reasoning, the CRA derives a whopping $53.6 billion per year drain on the economy.

Most other uses of chlorine are far less expensive to phase-out. Even according to CRA's own cost estimates:

- Over half of all chlorine use examined could be phased-out for only about $4 billion per year;
- 85 percent of the chlorine could be phased-out for $11.6 billion per year;
- Over 95 percent of the chlorine could be phased-out for $17 billion per year;
- 97.6 percent of the chlorine could be phased-out for less than $22 billion per year.

When compared with other expenses -- such as the $100 billion to 200 billion annual price for health care costs associated with the effects of persistent toxic substances, or the $90 billion per year that industry spends to "manage" pollution after it has been created -- the chlorine phase-out seems far less daunting.

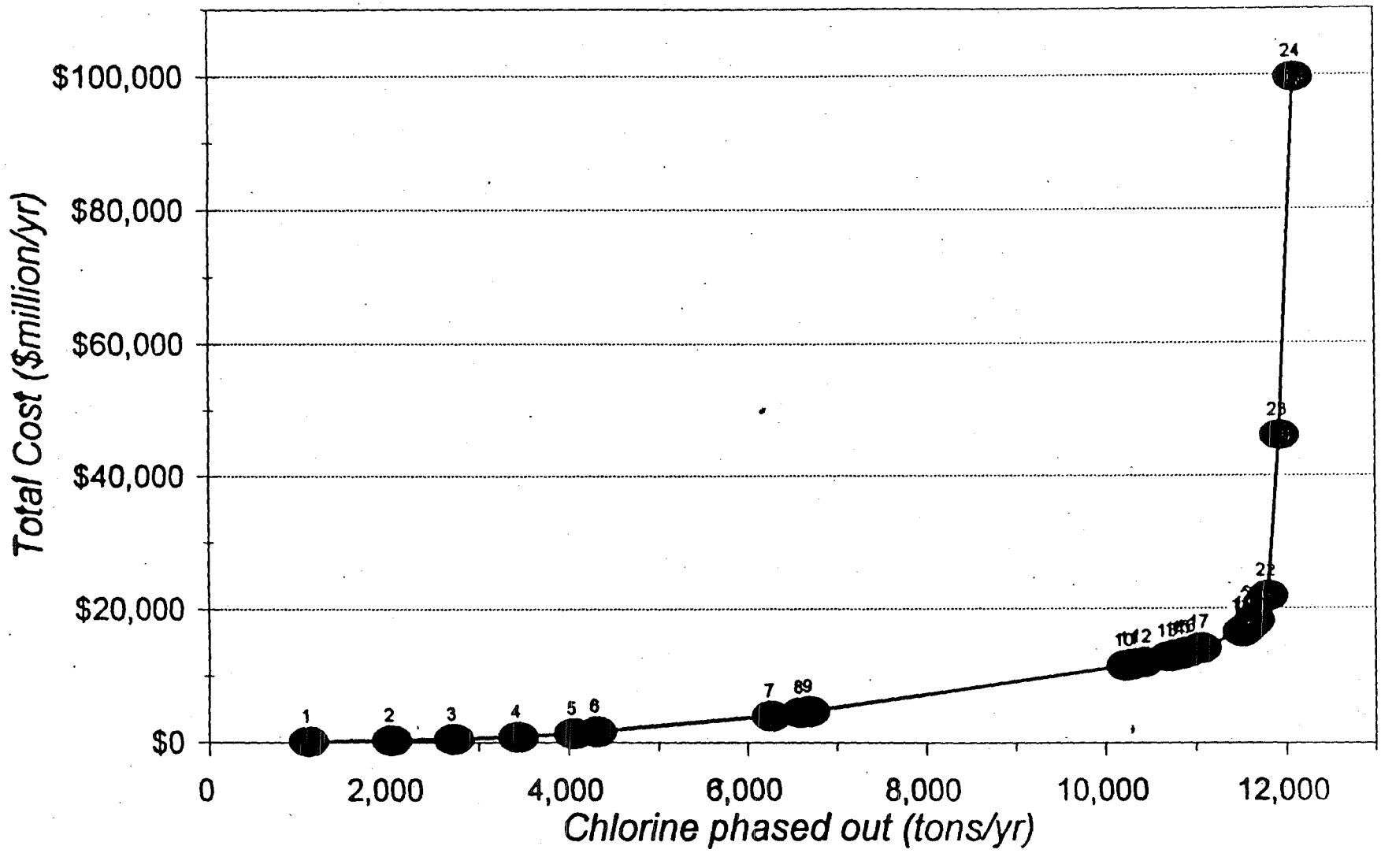
Using the best alternatives will lower costs.

CRA assumes that very expensive, inefficient alternatives will be used instead of chlorine and organochlorines, even when more affordable and effective processes are available. The result is a drastic overestimation of the costs associated with the chlorine phase-out.

For instance, CRA assumes that dry cleaners will replace perchloroethylene with Stoddard solvent, a flammable and toxic chemical that will require dry-cleaners to replace all their existing equipment at a cost of $4.6 billion. However, a recent EPA pilot study found that a solvent-free alternative cleaning method that eliminates toxic chemicals is equally effective, requires a very low initial investment, results in decreased operating costs, higher profits, increased employment and wages, and better return on investment than chlorine-based dry cleaning.

Total cost of phasing-out chlorine

by sector, U.S. and Canada



ata source: Charles River Associates, 1993 (see table)

Another example of CRA's unrealistic cost assumptions is the prediction of a $24 billion per year cost from the phase-out of chlorine-dependent pesticides. CRA derives this number by rejecting the effectiveness of alternative pest management strategies and assuming that the phase-out of these pesticides will result in a 20 to 70 percent decline in agricultural yields and the forced cultivation of tens of millions of additional acres to offset massive crop loss.

A recent report from the U.S. National Academy of Science, however, reached a far different conclusion. The Academy's Board on Agriculture surveyed alternative farming practices and found that farmers who have reduced or eliminated their use of pesticides have maintained or even increased their yields, have lowered production costs and increased financial returns. [7]

CRA's estimate of a $53.6 billion/year cost associated with phasing-out pharmaceuticals is similarly unrealistic. CRA assumes that all pharmaceuticals that involve chlorine in the manufacturing process will be immediately phased-out and that the result will be greater disease, longer hospital stays, and astronomical national costs. But this nightmare scenario is unrealistic for at least three reasons:

- First, all proposals for phasing-out chlorine have included provisions to exempt minor chlorine uses that serve a compelling need and for which alternatives are not available.
- Second, CRA overestimates the number of pharmaceuticals that would be affected even by a total chlorine ban. CRA calculates that 85 percent of all pharmaceuticals are chlorine-dependent, but only 20 percent actually contain chlorine; the rest involve chlorine, organochlorines, or chloride salts in the manufacturing process but not in the final product. Many of these -- such as the 7 percent containing hydrochloride salts or additional quantities made with other inorganic chlorides or acids -- would not be affected by a chlorine phase-out policy.
- Third, the majority of pharmaceuticals now made with chlorine could be produced through alternative means. In CRA's analysis, pharmaceuticals that do not contain chlorine but are made in processes that use chlorinated solvents, intermediates, coating agents, or extractants account for 58 percent -- of all pharmaceuticals.

  Chlorine-free alternatives are available or can be developed for these in-process uses. For instance, up to 65 percent of chlorinated solvent use in the pharmaceutical industry can be feasibly eliminated using available technologies, according to a recent report by the Metropolitan Water District of Southern California and the Environmental Defense Fund. [8]

  Water or other chemicals can replace chlorinated coating agents, as demonstrated when Rikker Laboratories of the 3M corporation, a major American manufacturer, replaced organic solvents with a water- and heat-based system for coating tablets. This system now saves the company $15,000 per year and has

allowed the company to avoid the purchase of $180,000 in pollution control equipment. [9]

Alternative processes are already in use in other industries for extraction, including substitutes that use pressurized water or gases. Alternatives are even available or in development even for chlorinated intermediates in this industry: the French firm Sipsy has substituted a hydrocarbon catalyst for an epoxidation process in the manufacture of chiral pharmaceuticals that used formerly relied on a chlorinate intermediate. [10]

Industry overestimates job displacement.

CRA asserts that there are 370,000 jobs "directly dependent" on chlorine and an additional 950,000 jobs created indirectly when the directly employed workers spend their wages. Rather than calculating the employment effects of implementing alternatives to chlorine, CRA simply presents these totals, implying that all of these jobs will be lost.

Industries that now use chlorine and organochlorines to produce other goods or services, however, will not shut down as chlorine is phased-out; they will adopt alternatives. Phasing out chlorine does not mean that no one will purchase or produce food, cars, flooring, or even plastics and many other chemicals-- it simply means they will use chlorine-free materials and processes to do it. In general, jobs in these industries will not be eliminated.

Of the 370,000 "directly chlorine-dependent" jobs in the CRA study, almost half are workers in plants that fabricate PVC products. Even in this industry, many or even most jobs will be preserved, since most products now made of PVC (with the conspicuous exception of unnecessary packaging) will still be made, but with other materials. And jobs lost from production of the raw PVC resins and its feedstocks would be offset by job gains in the manufacture of the substitute raw materials, often in the same plant or area. According to an economics consultant's report prepared for the IJC's Virtual Elimination Task Force, a program to phase-out PVC would result in no net decrease in jobs:

"The impacts on employment would be expected to balance out between the PVC and the substitute sectors." [11].

For instance, one of the world's largest flooring manufacturers, Tarkett AG, recently announced it will phase-out all PVC products from its line and substitute chlorine-free plastics and other materials. Tarkett workers will continue to be employed, they will simply use a different raw material to produce flooring. As noted above, Dow Chemical has begun to produce alternative chlorine-free plastics for products now made with PVC, presumably creating new jobs in the process.

Because this is such a large chlorine-use sector, there is still some potential for economic dislocation among those employed in the production of PVC raw resins and feedstocks, however. As described later in this report, careful transition planning is thus essential to insure that investment in new job creation is targeted for those areas in which dislocation may occur and additional programs are available to provide for incomes, benefits, and educational opportunities for any workers whose jobs are lost.

ECONOMIC BENEFITS OF PHASING OUT CHLORINE

Conspicuously absent in the CRA report is any mention of the economic benefits associated with phasing-out chlorine. Many chlorine-free alternatives are more efficient, create new jobs, and lower production costs in comparison to chlorine-dependent processes. A complete evaluation of the economic benefits of the chlorine-phase-out is beyond the scope of this document, but a few examples illustrate potential cost savings and job creation.

In many cases, implementing chlorine-free alternatives actually creates large numbers of new jobs, since the alternatives often substitute labor for the "convenience" of chemicals, as discussed further below. And since the wages paid to these workers will also indirectly create substantial numbers of jobs, the positive employment effects of these alternatives will be multiplied.

According to an economic consultant's report for the IJC's Virtual Elimination Task Force on the economic instruments and impacts that could be associated with a phase-out of industrial products and processes that generate persistent toxic substances, particularly PVC:

> *"On balance, the actions really substitute one set of human activities for another. In the absence of adaptation and innovation by the sectors targeted for economic instruments towards the "new" activities, there will be sectoral shifts to balance out.*
>
> *Given the relative capital and labour intensities of the alternatives, the net employment impacts are likely to be positive, both in terms of number and quality of jobs. The virtual elimination strategy, and the general pollution prevention actions that implement it, involve creative, knowledge-intensive activities that are emerging as economic strengths.*
>
> *The new activities will spur sustainable development, which is a form of economic development that enhances the resource base rather than degrades it. There will likely be a substantial netting out or balancing of the long-run adjustment costs, as there is a need to account for the opportunity cost-savings involved in the "capital switching" (capital accumulation in the new activities and capital decumulation in activities that generate persistent toxic substances) that will occur." [11]*

Pulp and paper.

The pulp and paper industry consumes about 16 percent of all the chlorine produced in the U.S. and Canada. Meanwhile, 27 mills worldwide -- most in Europe -- now produce totally chlorine-free (TCF) bleached pulp using primarily oxygen, ozone, hydrogen peroxide bleaching methods. The TCF product is of sufficient strength and

brightness to satisfy the most demanding markets. [12] The highest-profile newsweekly published in Germany -- Der Spiegel, often called the "Time Magazine of Germany" -- is now printed on TCF paper.

CRA estimates that the transition to a chlorine-free pulp industry would require an investment of $9 billion and result in increased costs of $2.36 billion per year. But the facts suggest that following an initial investment, TCF pulp is actually far less expensive to produce than chlorine-bleached pulp. The savings come in a number of ways.

- TCF mills reduce their chemical costs by an estimated $5 to $10 per ton. Based on current U.S. and Canadian production of 37 million tons of bleached pulp per year, total potential savings in the U.S. and Canada would total $185 to 370 million per year. [13]
- TCF mills require only one-eighth to one-half the energy of a chlorine-bleaching mill. [13] Potential energy savings in U.S. and Canadian mills would total 2.4 to 4.2 billion kilowatt-hours per year, with a financial savings of $108 to $189 million per year, assuming a median industrial electricity rate of $.045 per kWh. [14]
- Additional savings include substantially reduced costs for water use, effluent treatment, and disposal of contaminated sludge.
- Costs for lawsuits, remediation and liability for organochlorine contamination are also eliminated. One major U.S. pulp mill is facing lawsuits with up to $10 billion in damages for dioxin contamination of a receiving stream.

Once a pulp mill eliminates chlorine bleach, it can then pursue even greater savings by creating a closed-loop system. Closed-loop mills are currently considered technically feasible and clearly the wave of the future for the paper industry, but they can only be achieved when chlorine -- and its corrosive by-products -- are entirely eliminated from the process. [15] Closed-loop mills offer even greater opportunities for cost savings:

- A new closed-loop mill can be built for $40 million less capital than a traditional mill.
- A closed-loop mill can realize massive savings on chemical, water, and energy costs. Savings are estimated at $35 per ton of pulp, or about $1.4 billion per year if the entire U.S. and Canadian industry converted to such systems. [16]

The failure of North American mills to adopt TCF technologies also jeopardizes their future viability in the global marketplace. European markets are increasingly demanding TCF paper, and North American markets are following quickly behind. [17] As European mills change their production technology to meet this changing demand, U.S. and Canadian mills risk losing substantial ground with their refusal to adapt.

Industry analysts have warned that the North American industry is at risk of losing market share to European and other mills, with potential severe effects on the viability of the industry and the security of its workers' employment. According to a major U.S. newspaper:

> *"The truth is, the world market for chlorine-free paper is growing rapidly, and our international competitors are already ahead of American producers in the development and installation of chlorine free technology," one major newspaper wrote recently. [18]*

According to the editor of a leading paper industry magazine:

> *"Let's face reality. Whether we like it or not. Whether we worry about the cost and the cash flow - it is going to happen. Those who make those big decisions for their companies can't defend a chlorine position by saying, "The hell with you dumbbells, you customers, you merchants, you governments officials, we'll take you all on. We'll stuff our products down your throats!" It reminds me of the arrogant U.S. automobile industry approach. But guess what? The auto industry had it's clock cleaned, as will some major U.S. pulp and paper companies, if they think they can buck the trend." [19]*

According to another trade report:

> *"Market pulp producers using chlorine and its compounds are in danger of remaining on the defensive for a long time to come. For that reason, we believe that the tide will sweep the market pulp industry towards the final elimination of chlorine from its bleacheries. Whether or not you believe that organochlorine effluent from pulp mills is harmful to humans, a failure to respond to the rising environmental tide of the 1990s could well lead to an ebb in your company's fortunes." [12]*

Dry cleaning and solvents.

A recent U.S. EPA study considered the economic implications of converting dry-cleaning facilities that currently use perchloroethylene (PERC) to a solvent-free method based on spot cleaning, steaming, and pressing.[20] EPA began the project because future regulations are expected to require dry cleaners to reduce their emissions of PERC by installing costly pollution control equipment, at costs that could put many small operators out of business.

The study found that multi-process wet cleaning was equally effective and associated with significant economic benefits. Compared with a PERC-based system, the solvent-free system:

- Required 42 percent less capital investment to install;
- Offered a 78 percent better return on investment;
- Resulted in approximately equal operating costs by eliminated costs for chemical procurement and disposal, but required additional labor;
- Increased profits by 5 percent;
- Increased total employment by 21 percent;
- Increased total wages by 38 percent, and because the jobs in a solvent-free facility require more skill.

Based on these figures, a national program to convert all the nation's dry cleaners to the solvent-free method could result in significant economic benefits. Based on current estimates of 158,000 jobs in the dry cleaning sector in the U.S. alone, a conversion to multi-process wet-cleaning would result in:

- The creation of 33,170 new jobs;
- A net increase in wages of $606 million per year.

An even larger quantity of chlorinated solvents are used in industrial settings, such as in the manufacture of electronics equipment, automobiles, and other equipment. As in the case of dry cleaning, chemical solvents in these industries carry significant costs for chemical procurement and management. Solvent-free alternatives are available now for virtually all uses of chlorinated solvents. Many companies have already realized significant cost savings by substituting mechanical or aqueous cleaning or coating processes, by redesigning the process to eliminate the need for a solvent entirely, or by substituting labor for chemicals. In most cases, companies report cost savings; in some cases, jobs are created. [21,22]

For instance, a medium-sized Swedish manufacturer of lighting fixtures for interior and exterior use employing about 350 persons successfully replaced chlorinated solvents for degreasing, painting and coating with aqueous cleaning and powder-based paints. Through improved material and energy efficiency and reduced waste disposal costs, the company's savings have been estimated at 2.4 million SEK per year, or about 300,000 US dollars. [23]

According to one U.S. electronics company that recently eliminated its use of chlorinated solvents entirely,

> *"Waste management is an unproductive drain on company resources.... Waste elimination avoids waste management cost. As a result, waste elimination conserves company funds for productive investment in new products and*

improved product quality.... Waste elimination is a necessity for competitive survival." [24]

Pesticides.

The widespread use of pesticides since 1950 replaced labor with the apparent efficiency of chemicals. As the financial and economic costs associated with pesticide-intensive agricultural have become more apparent however, alternative chemical-free methods of agriculture have been developed or rediscovered. These methods include including improved choice and rotation of crops, mechanical methods of weed and pest control, introduction and maintenance of natural predators, and use of biological pesticides. [7]

As noted above, a comprehensive review of alternative farming practices by the National Academy of Sciences [7] found that farmers who have reduced or eliminated their use of pesticides have benefited economically. Pesticides can account for as much as 20 percent of the variable costs of producing a crop, and chlorine-dependent pesticides carry an annual price tag of about $8 billion to U.S. and Canadian farmers. [1] Pesticide-free alternatives eliminate this cost entirely, substituting labor or other methods.

In every case studied, the Academy found that yields on farms practicing alternative agriculture increased or stayed constant, that costs declined, and profitability increased. Further, because these farms were typically more diversified, their owners reduced the risk and variability of net returns. The major economic barrier to wider implementation of these processes was found to be federal programs that encourage the use of pesticides and fertilizers.

The academy did not attempt to calculate the potential cost savings of a national program to phase-in pesticide-free agriculture. Figures presented in the report suggest the savings opportunities may be large: a program to reduce pesticide use on just 9 crops in a 15 state area yielded a net savings of $578 million in additional returns to farmers, for instance. Total U.S. and Canadian savings from the reduction or elimination of pesticide use would likely be in the billions of dollars.

The Academy also found that alternative agriculture typically requires more labor with greater skills and knowledge. The Academy did not calculate the number of jobs that might be created by a national program to move towards pesticide-free agriculture. In the period from 1947 to 1985, pesticide use nationwide increased from near zero to about 250 million pounds per year. In the same period, farm employment dropped from 10 million (about 17 percent of the total work force) to 2.5 million (2 percent), due to increased use of pesticides, fertilizers, and more efficient machinery.

Health and remediation costs.

Phasing-out chlorine will virtually eliminate discharges of organochlorines to the environment, with a subsequent decline in expenditures associated with this pollution. The cost of pollution is seldom included in economic models but includes health care costs and lost productivity due to health effects among the general population, and the workers and communities most directly exposed, environmental clean-up, and pollution control, management and disposal.

A recent report for the IJC's Virtual Elimination Task Force estimated that health care costs associated with the effects of persistent toxic substances in the U.S. and Ontario range from $100 to $200 billion per year. If organochlorines account for half of these costs, eliminating these expenditures would result in savings of $50 to $100 billion, largely offsetting the costs of a chlorine phase-out, even according to CRA's estimates. [25]

The Environmental Protection Agency has estimated that U.S. pollution control and disposal costs about $90 billion per year. These costs are expected to reach $171 billion annually by the year 2000. [26] When chemical use is eliminated, the cost of inefficient control and management is also eliminated. The portion of total pollution control costs attributable to chlorine-based compounds is unknown, but is likely significant, considering the quantity of these chemicals used and their dominant presence on lists of regulated chemicals. If organochlorines account for only one-fourth of total pollution control expenditures, the chlorine phase-out would result in savings of $22 billion annually, with savings increasing to $43 billion per year by the year 2000.

Continued production and discharge of persistent toxic substances will also result in increased future costs for site remediation. Preventing these discharges will obviate such potentially massive expenditures. The cost of cleaning-up just 10 of the 43 Areas of Concern in the Great Lakes has been estimated at up to $3.4 billion. [27] Clean-up costs for just the four largest hazardous waste sites along the Niagara River are $6 billion over the next 30 years and $19 billion over the next 100 years [28] Published estimates to remediate the hazardous waste legacy of the last four decades in the U.S. are in the range of $480 to $1,000 billion, with $750 billion the most likely [29] By preventing continued discharges of persistent organochlorines, the chlorine phase-out would result in savings in remediation costs, conservatively estimated over a two-decade period at $20 to $100 billion.

Economic stimulus of the transition.

CRA has estimated that the transition to a chlorine-free economy would require a one-time investment of $67 billion in new equipment to produce the alternatives in necessary quantities.

Such an investment in construction of new equipment in manufacturing industries, in water treatment plants, and other sectors would provide a powerful stimulus to the economy, creating a large number of direct jobs and an even larger number of indirect jobs.

In manufacturing industries, an investment of 37.7 dollars creates one hour of labor. The $67 billion capital investment in the transition to a chlorine-free economy would thus create approximately 925,000 job-years of new employment -- or an average of 92,500 constant jobs during a ten-year transition period. [30]

PROTECTING WORKERS AND COMMUNITIES

As it faces the chlorine phase-out, the industry has begun a long-range strategy to protect its financial interests. But its plans have provided no protection for the workers and communities who will be affected and for whom the industry has professed such concern in public.

Although a chlorine-free economy will create new jobs and economic cost savings, there are some workers employed in the manufacture of chlorine and organochlorines whose jobs will be lost in the transition. Communities dependent on these industries will also be affected.

These workers and communities should not be forced to bear the economic burden of the transition to a chlorine=free economy. It is essential that the phase-out be implemented so that dislocation is minimized, costs and benefits equitably distributed, and opportunities for new employment and investment maximized.

A rational planning process can reduce and mitigate the economic disruption associated with the transition. First, efforts should be made to locate new investment and job creation in the same communities in which the most dislocation is likely. Transition planning should place priority on keeping people employed by directing new development to those areas in which it is most needed.

Second, workers whose jobs are eliminated should be offered the opportunity for meaningful new employment. One proposal to insure that displaced workers are protected is the GI Bill for Workers, advocated by the Oil Chemical and Atomic Workers International Union. [31] This program would provide full income protection, up to four years of higher education and health care coverage to all workers whose jobs are lost because of phase-outs of industries that are incompatible with environmental concerns. The program would be funded by taxes on the activities of polluting industries themselves.

Funds should also be provided so that communities affected by the chlorine phase-out can re-invest in clean, chlorine-free development to reinvigorate their local economies.

Worker and community protection program should be funded by a tax on the chlor-alkali process. The tax should begin at a modest level and rise over time. This way, funds can be built up to provide for the transition while creating an economic incentive for user industries to more quickly phase-out chlorine and organochlorines.

Revenues equivalent to those generated by the chlorine tax should be placed in a dedicated Chlorine-Free Transition Fund by the U.S. and Canadian governments. The fund should be used to aid the transition to a chlorine-free industrial society: for

protecting and assisting displaced workers, for redevelopment programs in affected communities, and to explore and demonstrate economically viable alternatives in those sectors in which further research and development is necessary. A board should be established to set the policy of the fund. It should include full participation by all interested parties, particularly workers and communities.

RECOMMENDATIONS: ELEMENTS OF A TRANSITION PLAN

Transforming our current chlorine-dependent economy into a chlorine-free industrial base is clearly a major social and economic undertaking. Implemented with careful planning, the transition can be economically beneficial and socially just. It can save money and create new jobs. Further, it can provide a model for how to undertake major economic change in a way that is humane and equitable for those most directly affected.

In implementing a sunset of the use of chlorine and chlorinated organics, governments should begin a transition planning and implementation process to begin a rational and equitable phase-out of chlorine and organochlorines. The process should include the following measures:

1. PRIORITY PHASE-OUT SECTORS.

Governments should begin by identifying priority phase-out sectors for early attention. Realistic goals and timetables should be established for each sector. There are four that should be given the highest priority: paper bleaching, solvents, PVC and pesticides.

These sectors consume about 7 million tons of chlorine each year, more than half of all the chlorine used in North America. With proper planning, they can be sunset with relatively low economic cost. This will eliminate major sources of organochlorine pollution to the Great Lakes ecosystem. In particular, the IJC should propose:

a) ***Paper bleaching.*** Sunset chlorine-based bleaching by the pulp and paper industry within 5 years.

b) ***Chlorinated solvents.*** Sunset production and use of chlorinated solvents with a target of completion of 1998 for the majority of applications. Allow the possibility of extensions for individual applications that prove to be difficult but essential.

c) ***Polyvinyl chloride plastic.*** Rapid phase-out of PVC that is used in disposable products or products with a short life expectancy. Establish a plan and time-table for the phase-out of PVC used in durable products that achieves the goal as rapidly as possible while avoiding unnecessary economic dislocations.

d) ***Pesticides.*** Establish a rapid phase-out for those pesticides that are most persistent in the environment and for all non-agricultural uses. Establish a longer term process for other pesticides that includes technical assistance, training and incentives for the agricultural sector.

e. *Incinerators.* In addition to these use sectors, there should be an immediate ban on the introduction of organochlorine-containing wastes into all combustion facilities, including incinerators for garbage, hazardous waste, hospital waste, and sewage sludge, as well as any boilers, furnaces, and kilns that also burn such wastes. Such a measure will eliminate a major source of organochlorine discharges and serve as an incentive for reductions in the use of chlorinated products and feedstocks.

2. SECOND-TIER SECTORS FOR SUNSET.

After addressing these priority sectors, programs should be developed to sunset other uses based on the following prioritization criteria:

- Industrial process that use large quantities of chlorine or chlorine-containing compounds should get precedence for phase-out over those that use small amounts;
- Processes or products associated with releases of persistent toxicants that are especially large or especially potent should be given precedence;
- Processes for which readily available alternatives are in commercial use in some countries or by some companies should be given precedence -- especially where there are phase-outs or phase-downs elsewhere in effect;
- Processes with alternatives that have the lowest long-term cost to the end-user should be given precedence.

Using the above criteria, the following additional uses of chlorine should get special scrutiny: chlorohydrins used in the production of propylene oxide and epoxy resins; phosgene used in the production of isocyanates and polycarbonates; chlorine used in the manufacture of titanium dioxide; and chlorine used for wastewater treatment. Each represents a large use of chlorine for which economical alternatives exist.

These four uses together consume over 3.1 million tons of chlorine per year in North America. When combined with the four priority uses listed earlier, we have identified eight uses that together consume more than 73 percent of all chlorine now produced.

3. CHLORINE TAX.

The U.S. should institute a tax on the chlor-alkali process that begins at a modest level and rises over time. An equivalent tax should also be collected on all off-shore imports of both chlorine-containing products and also alkali that has been produced by the chlor-alkali process. At the same time, chlor-alkali plants should no longer be allowed to purchase government subsidized electric power or purchase regulated electric power at less than average market rates.

4. TRANSITION FUND.

Governments should set up transition funds in amounts equivalent to what the chlorine tax generates. These funds should be used to aid the transition to a chlorine-free industrial society and in particular: for exploring and demonstrating economically viable alternatives and for easing dislocations to affected workers and communities -- particularly those associated with chemical manufacturing itself. A board should be established to help set the policy of the fund including representatives of the various stakeholder groups.

5. TRANSITION PLANNING.

Governments should establish a transition planning process for implementation of the chlorine sunset. The goal of this process is to minimize costs, maximize benefits, make certain both are equitably distributed, and mitigate negative impacts on workers and communities. The sunsetting strategy should include:

1. Realistic and measurable timetables for action;

2. Transition planning mechanisms that provide input from representatives of communities, labor, environmentalists, chemical producers and chemical users. A number of planning exercises should occur under the following general guidelines:

- Planning exercises should be organized around the proposed phase-out of specific industrial processes or clusters of industrial processes (including production, use, disposal or others) responsible for releases of persistent toxicants to the ecosystem.
- Each planning exercise should work within a framework that has already been defined. This framework could be a proposed timeline for a phase-out or could be some other specific objective. Participants should be asked to help define ways to achieve the objective that avoid unnecessary economic or social burden.
- While all participants need not endorse the objective of the planning exercise, it will be organized and facilitated to discuss and plan how the objective is to be accomplished -- not to revisit or challenge its desirability or necessity.
- Each planning exercise should involve representatives of a spectrum of affected interests. These include not only industry, environmental advocates and government agencies; but also representatives of workers, affected communities and the users or purchasers of affected commodities or services.
- Participants should have access to technical and economic expertise and everyone's input should be given serious, thoughtful consideration. The group should explore alternatives, obstacles and opportunities. Various scenarios can be explored, including elements such as bans, taxes, market forces, procurement policies, labeling requirements, building codes, and so on. Consensus will be sought, but it will not be required.

PROCEED WITH OR WITHOUT INDUSTRY'S COOPERATION

Affected industries should be invited to cooperate actively in the planning of the transition to a chlorine-free economy; however, industry – particularly the chemical industry -- should no longer have the power to block or veto implementation of measures necessary to protect the environment and mandated by the language of the Clean Water Act, the Great Lakes Water Quality Agreement, and other instruments. The U.S. government must now define a program to move forward, with or without voluntary cooperation from the chemical industry.

Some issues have been debated long enough and should now be put to rest. IJC boards and task forces should no longer provide a forum to continue debating:

- Whether the evidence linking toxic pollution to ecosystem and human health disorders is sufficiently strong to justify precautionary public policy conclusions;
- Whether a "Zero Discharge"/"Virtual Elimination Strategy" is appropriate, or what these terms mean;
- The validity of the Sixth Biennial recommendations and its selection of individual substances and specific classes of chemicals as sunset candidates, particularly organochlorines.

The International Joint Commission, the American Public Health Association, and other groups have already spoken very clearly on these issues. This position has been supported by communities throughout the nation, by scientists, and by international fora representing over 20 European governments.

There is no reason that governments should be compelled to revisit the same ground, again and again, risking paralysis and a loss of utility to the societies and agreements to which it is accountable and the ecosystem it is bound to protect. It is time to move the discussion from the question of *whether* to the planning of *how* to phase-out chlorine.

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