CHLORINE AND THE PAPER INDUSTRY

Chlorine And The Paper Industry is an exercise prepared by Alan R. Beckenstein and Brad Webb, the Darden School, University of Virginia, and Frederick J. Long and Barbra L. Marcus, the Sustainable Enterprise Program (SEP). It is intended for educational purposes only. Copyright ©1994 by the Sustainable Enterprise Program and Darden.

This exercise is a chapter in the book Stakeholder Negotiations: Exercises in Sustainable Development (1995) edited by Alan R. Beckenstein, Frederick J. Long, Matthew B. Arnold and Thomas N. Gladwin. The book contains six exercises that illustrate how different institutions place competing demands on the natural environment, how they attempt to incorporate these demands on the natural environment, and how they attempt to incorporate these demands into a sustainable development strategy.

For more than a decade, WRI's Sustainable Enterprise Program (SEP) has harnessed the power of business to create profitable solutions to environment and development challenges. BELL, a project of SEP, is focused on working with managers and academics to make companies more competitive by approaching social and environmental challenges as unmet market needs that provide business growth opportunities through entrepreneurship, innovation, and organizational change.

Permission to reprint this case is available at the BELL case store. Additional information on the Case Series, BELL, and WRI is available at: www.BELLinnovation.org.
During the 1990s, the pulp and paper industry was responding to pressure over a number of environmental and natural resource issues, including deforestation, recycling, and pollution. Foremost among the problems facing the industry was dioxin, an extremely toxic substance produced by paper companies in their chlorine bleaching processes. Many environmental and community groups, concerned about damaging health effects of exposure to dioxin, were calling for a complete elimination of chlorine from all industrial processes. Companies, viewing the scientific analysis as inconclusive, were considering modifications to chlorine bleaching to reduce dioxin emissions, but were unwilling to spend billions of dollars to put in place new equipment that could produce ‘totally chlorine-W’ paper.

All stakeholders were interested in developing an outline for the future course of the industry’s environmental actions. While candid discussion would entail risks for all stakeholders, the participants believed that new solutions could benefit their individual organizations, the paper industry, and society as a whole.

Forward-thinking leaders have proposed a dialogue session on the environmental future of the pulp and paper industry. You will represent one of three pulp and paper companies, the U.S. EPA, or a leading environmental group in this dialogue.
During the summer of 1994, an informal luncheon was managed in a private room at Duke Zeibert’s Restaurant in Washington, D.C. The chief executive officers (CEOs) of several pulp and paper companies had invited the Administrator of the U.S. Environmental Protection Agency (EPA) and the Executive Director of Greenpeace USA to a “power lunch” at which some “visioning about the future environmental strategy of the paper industry” would take place. Although the event was an unusual way of doing business for EPA and Greenpeace, their leaders could not resist their curiosity about such an intriguing topic. The EPA Administrator had been promised by the CEOs that this lunch would not be an attempt to lobby the EPA. Moreover, the presence of Greenpeace’s Executive Director guaranteed that the agenda would be novel.

The pulp and paper industry (and the broader forest products industry) faced a large number of environmental issues in the 1990s. Forest management issues — endangered species protection and harvesting practices — had received sufficient attention that President Clinton held a conference on the topic in the Pacific Northwest in early 1993. Public pressure and governmental regulation on waste disposal (including chlorine byproducts) had intensified. The issue of mandating waste paper content for new paper products was also being debated. Many of these debates were similar in form — environmentalists and business people attacked each others’ widely divergent scientific, health, and economic data. Outcomes were usually unsatisfying to all stakeholders, a reflection of mistrust and misunderstanding.

Of the various environmental issues that they had faced in recent years, CEOs of pulp and paper companies were most vexed by the public attacks on their use of chlorine to bleach paper. Chlorine use produced waste products called organochlorines, which included a particular class of compounds called dioxins. The industry produced less than one pound of dioxin per year; still, scientific evidence suggested links between even minute levels of dioxins and cancer. While the evidence was not conclusive, environmentalists argued that such evidence should provide sufficient cause for EPA to ban the use of chlorine, requiring companies to adopt totally chlorine-free (TCF) processes. Others felt that conversion to a less toxic process, called elemental chlorine-free (ECF), that replaced chlorine gas with chlorine dioxide would suffice to reduce public risk. Still others felt that the considerable economic impacts that would result from such conversions were unwarranted, given the inconclusive data. All stakeholders viewed chlorine as a “centerpiece” issue; significant risk and opportunity were at stake.
A primary motivation for a broader, more open discussion of chlorine and other environmental issues was a regulatory process called the “cluster rule.” In 1990, the EPA had proposed to structure regulations on an industry basis, rather than the traditional single-media approach of regulating water, air and solid waste issues separately. The paper industry had been the first cluster selected by EPA to test its new policy approach. This approach promised that EPA would become better informed about the realities of competition and the costs and benefits of environmental investments in the pulp and paper industry. It also held out the possibility of EPA understanding the cross-media tradeoffs of regulation (e.g., a decrease in air emissions might be accomplished by increasing water emissions). Both the corporate leaders and environmentalists had been somewhat disappointed with the preliminary results of the cluster process. EPA was expected to adopt a set of standards at a “high” ECF level (more than simple chlorine dioxide substitution, but less than TCF). Still, they saw hope in the methodology — dialogue — that the cluster rule had applied.

Some companies preferred a minimum ECF standard (chlorine dioxide substitution). This would lower, but not completely eliminate, emissions of organochlorines including dioxin. Environmentalists, led by Greenpeace, argued that this approach was insufficient. While using the rather inflammatory phrase “The Product is the Poison” as its motto, Greenpeace had marshalled significant scientific support for its position that chlorine should be phased out of all industries over a period of time. The pulp and paper industry should be the first to adopt TCF technologies, Greenpeace argued, because these technologies had been proven feasible and economic in marketplaces such as Sweden, Germany and Austria.

Paper industry executives questioned the scientific and economic bases of the analyses of Greenpeace, other environmentalists, and federal agencies. A decision to ban chlorine and chlorine compounds would shake the financial foundations of many U.S. pulp and paper producers. EPA estimated that the high ECF standard would cost $30-$45 million per facility, and $4 billion in total (for 90 U.S. bleached kraft mill facilities). Several industry estimates placed the total costs closer to $10 billion. The costs of ECF, if mandated, could be three times higher. Such investment pressures could not have come at a worse time for the industry, as the recession of the late 1980s had reduced companies’ profits and increased their debt-equity ratios. [Appendix A contains some estimates of the costs to industry of the proposed regulations.]

Rather than turn away from public pressures, some industry leaders resolved to face EPA, Greenpeace and other stakeholders directly. By sharing interests and ideas, they might create a more certain path for their companies. While questioning the need for ECF in their production facilities, they feared an even worse option. EPA could force conversion to ECF now and require TCF later. Knowing the future directions of regulation now would help promote efficient investment policies. Perhaps EPA would consider voluntary compliance goals based on an informal “covenant.” While the CEOs were far from unanimous in supporting proactive measures, a number of them agreed to participate in the discussions with EPA and Greenpeace.

At the lunch at Duke Zeibert’s, cordial discussions led to a specific proposal. The corporations, EPA, and Greenpeace would sponsor a “Forum on the Environmental Future of the Pulp and Paper Industry.” Each organization would select a team of senior executives to attempt to define collectively a “green” path for the industry. To simplify the process and to entice Greenpeace to participate, the focus of this initial forum would be “Chlorine.”

Exercise 4: Chlorine and the Paper Industry
The forum would entail presentations by all stakeholder teams and attempts to induce voluntary collaboration among diverse teams. One objective would be to propose a voluntary program of long-term goals that companies would attempt to meet, with the assistance of EPA, Greenpeace, and other stakeholders. The *quid pro quo* for the companies would be an informal understanding (the covenant) by the non-company stakeholders to shape future regulation in the direction of the voluntary program, supplemented by the knowledge gained during the program. The burning question was whether even the companies participating in the forum had sufficiently similar circumstances and objectives to build consensus on a long-term environmental strategy for the industry.

Each senior executive team would later report to its governing body. For the paper companies, the teams would report to the environment committee of the board of directors. The EPA team would report to the Administrator and her senior staff. The Greenpeace team would report to the Executive Director and the policy committee of the board of directors.

THE INDUSTRY

The pulp and paper industry was one of America’s largest with more than 500 manufacturing facilities owned by over 200 companies located in 42 states. According to the American Forest and Paper Association (AF&PA), paper and allied products sales totaled $129 billion (4.5% of U.S. manufacturing output) in 1993.¹

There were two types of facilities in the industry. Integrated pulp and paper mills produced pulp on-site from virgin wood fiber, secondary fiber, or non-wood fiber, which was then made into paper or paperboard products. Non-integrated paper mills manufactured paper or paperboard products from pulp produced elsewhere. Various methods of pulping were used at these mills. In kraft pulping, the wood chips were boiled with caustic soda, which efficiently removed the lignin and resins from softwoods and produced a dark-brown, strong pulp. [See Appendix B for a description of the papermaking process.]

Pulp and paper mills consumed large amounts of wood and generated great amounts of waste products, including over 1.5 trillion gallons of waste water in 1992. In general, the quality of waste discharges was improving, but pulp and paper production still resulted in large amounts of pollutants discharged to surface waters and to the air. The industry also generated large amounts of industrial sludge, which had to be landfilled or otherwise disposed of, as a waste treatment byproduct.²

In general, the U.S. pulp and paper industry was very cyclical and closely followed the performance of the U.S. economy. The recession experienced in the United States during the early 1990s was severely felt by the industry. In fact, 1993 represented the fourth consecutive year of declining profits, resulting primarily from severely depressed prices for the industry’s products. It was believed that prices in the industry had bottomed out by 1994 and would soon rise, which would improve profitability.

The pulp and paper industry was a business that required significant capital investment, about $1.4 billion per year. Investment in new mills would often be recouped over a ten to twenty year time period. Most companies in the industry funded capital expansion through the use of long-term debt if funds for such expansion could not be generated internally. When building facilities overseas, American pulp and paper companies generally built plants to meet U.S. health, safety, and environmental standards in order to avoid potential litigation in the event of an accident or environmental release.

*Stakeholder Negotiations: Exercises in Sustainable Development*
The pulp and paper industry was truly global, and U.S. companies faced competitors from Scandinavia, Canada, Japan, China, and Brazil in a worldwide market. End products included printing and writing papers, tissue papers, and packaging and containing materials. Consumer demand for the brightness, strength, and softness of these products varied widely. For example, German consumers were generally well-educated about environmental issues and had created a well-developed market for both TCF and ECF paper products. German regulation was also supporting the reduction or elimination of chlorine bleaching.

In contrast, the market for TCF products in the United States and other major countries was rather small, less than 1% of the total market. TCF products were viewed as being of generally inferior quality in terms of brightness, feel, and look. Awareness of environmental issues in the United States generally lagged those in Europe; still, it was possible that the market for TCF products could "take off once some threshold level of awareness was reached." This argument was made by Greenpeace as it attempted to create markets for environmentally friendly paper products.

Environmental pressures had previously influenced demand for paper products. During the 1980s and early 1990s, government regulation and increased consumer awareness led to a significant rise in the demand for recycled products. As a result, the percentage of the fiber supply used to produce paper that was recycled grew from 23% in 1978 to 30% in 1991. This percentage was expected to rise.

**Organochlorine/Toxics Overview**
Chlorine is a highly reactive gas at room temperature and appears only in combined form (e.g., sodium chloride) in nature. It is an essential precursor of many industrial compounds, and few other chemicals are produced worldwide in larger quantities.

Approximately 15,000 chlorinated compounds are currently in industrial use, including pharmaceuticals, plastics, and disinfectants for drinking water. The largest single use of chlorine is in plastics such as polyvinyl chloride (PVC). The pie chart below represents industry percentages of total chlorine use.

![Pie chart showing industry percentages of total chlorine use](chart.png)

The chlorine used by the paper industry during the bleaching process combines with organic molecules from the wood to form organochlorine compounds, which are then discharged in the mill’s effluent. Waste is typically processed in a secondary treatment plant before release to surface waters or to industrial sewers leading to municipal sewage treatment plants. Organochlorine compounds have been found in fish and sediments downstream from paper mills.

In 1994, the average kraft mill produced between 600 and 1,000 tons of pulp per day, which translated into a daily production of between 30 and 80 tons of organochlorines. As of 1994, over 300 chlorinated organic compounds had been identified in paper mill effluent. The presence of organochlorines in mill effluent was typically determined through an indicator test which measured the presence of adsorbable organic halogens (AOX).
organochlorines have been associated with a number of animal and human health risks. They have been linked to cancer in humans, as well as non-cancer problems including endocrine, immune, and neurological system dysfunction. Many organochlorines have been identified as carcinogenic (cancer-causing), mutagenic (chromosome-damaging), or teratogenic (causing birth defects). Environmental groups claim that organochlorines are uncommon in nature, while industry groups claim they are abundant in marine ecosystems. Some are bio-accumulative, in that they remain in the flesh of animals that ingest them for extended periods of time, and become more concentrated as they pass through the food chain. Bioconcentration of organochlorines has been observed in salmon, marine mammals, and birds of prey. Well-known organochlorines include DDT, PCBs and chloroform. Chloroform, which is known to cause liver disease and is a suspected human carcinogen, is contained in paper mill effluent. The average U.S. kraft paper mill releases from 400 to 660 pounds of chloroform per day. Dioxin, a name attached to an entire family of chemicals, is the best known of all organochlorines associated with effluent discharges from paper mills. Furans are close chemical relatives of dioxins. A joint study conducted by EPA and the pulp and paper industry found dioxin in “treated effluent, wastewater sludges, and bleached pulp from mills that use chlorine-based processes.” Although the U.S. pulp and paper industry produced very small quantities of dioxin (total annual production of less than 1 pound for all U.S. pulp and paper companies in 1994), even these small quantities were seen as a significant threat to the environment and human health.

During the mid-1980s and early 1990s, EPA undertook several major studies to examine the impact of dioxin on human health and the environment. In September 1994, the agency released a 2,000 page study which concluded that dioxin probably causes cancer, as well as a range of hormone and immune system disorders, in humans. The study provoked more disagreement. Environmentalists found the evidence to be compelling. Industrial leaders found it inconclusive.

In addition to dioxin and other organochlorines, regulators were concerned about other measures of paper mill effluent, including biochemical oxygen demand (BOD) and color. BOD measured the quantity of oxygen required for biological degradation of the organic matter in the effluent, including cellulose fibers. If the BOD of the mill effluent was high, there was less oxygen available for aquatic life in the waters downstream of the paper mill, resulting in “dead zones.” Millions of gallons of process water were used daily by the average kraft mill, and the bleach plant effluent carried with it the dark brown color of the pre-bleached pulp, resulting in severe and unsightly discoloration of surface waters into which the effluent was discharged. Total suspended solids, or TSS, was a measurement of the total quantity of solids present in a specified discharge volume.

Trends in Environmental Regulation
In November 1993, the EPA proposed an integrated rule, known informally as “the cluster rule,” for the pulp and paper industry. The proposed cluster rule combined elements of the Clean Water Act and the Clean Air Act and was intended to reduce significantly releases of air and water pollutants from pulp and paper industry facilities. (To simplify this exercise, the emphasis is on the waiver regulations of the proposed rule, and the discussion focuses on the impact on the 90 U.S. kraft pulp mills.)

[Appendix A contains detailed information about the effluent guidelines contained in the proposed cluster rule.]
Organochlorines and dioxin were primary targets of the water section of EPA's proposed cluster rule. The draft cluster rule established allowable limits on a number of "conventional" pollutants, including BOD and TSS. The rule also established allowable limits on nonconventional pollutants such as AOX, the proxy used for measuring organochlorines. The proposed standards for AOX indicated that the regulations would be pushing companies to reduce organochlorines by an average of 50%.

EPA based these emission limits on the top-performing 50% of facilities in the industry. About one-third of all bleached kraft mills had already implemented a "high" version of ECF (100% substitution of chlorine dioxide for elemental chlorine plus extended cooking or oxygen delignification); the rest of the facilities would be required to implement a process change in addition to chlorine dioxide substitution. Extended cooking lengthened the period in which chips were cooked before bleaching, significantly reducing organochlorine and BOD levels, although dioxin could still remain above detectable levels. Oxygen delignification introduced a step between pulp washing and bleaching, which reduced the need for bleaching. When combined with 100% substitution of chlorine dioxide, oxygen delignification would significantly reduce organochlorine and BOD levels, as well as dioxin formation.

Industry representatives disagreed with the cluster rule's goals and its estimated costs. Many companies had voluntarily reduced AOX to current levels. Now it seemed as if their voluntary efforts had only bought them a lower "baseline" against which they would have to reduce further. Industry executives believed that the costs of this additional reduction greatly outweighed the benefits. Regulations would force them to reduce to proposed AOX levels within 36 months. This was unrealistic given the long capital equipment depreciation schedules in the industry — at least twice as long a period would be required to come into compliance with proposed levels.

Furthermore, industry estimates of the costs of compliance differed greatly from EPA's. Executives from International Paper had put the cost of converting to 100% substitution with oxygen delignification at approximately $104 million per mill, or over $9 billion for the industry as a whole. Industry leaders also questioned EPA's estimates of the benefits of such a regulation. They were overstated significantly, allegedly due to mathematical errors that EPA officials had made in their calculations. Executives pointed to Executive Order 12866, signed on September 30, 1993, which required that regulation be designed to protect the environment "without imposing unacceptable or unreasonable costs on society." Based on these estimates, industry leaders argued that the cluster rule imposed unnecessary costs on the industry as a whole, while generating only minimal environmental benefit.

Industry leaders predicted major economic impacts if the proposed regulation were implemented. Facilities with out-of-date operations would likely close rather than meet the stringent AOX requirements. More than 30,000 jobs might be lost. And prices to consumers would surely rise, possibly by 10%, if companies were to receive an adequate return on the new investments. AF&PA, with support from its leading companies, had proposed 100% chlorine dioxide substitution as the solution to organochlorines and dioxin problems. Dioxin could be reduced below currently detectable levels, and AOX could be reduced by 30% or more. The cost of this solution to the industry was estimated at from $2 million to $25 million per facility, or about $1.2 billion.

Future Directions
By the time the forum would be convened, EPA would have moved well down the path...
toward a final form for the cluster rule. It would take compelling arguments to affect the outcome. On the other hand, the EPA Administrator faced some tough decisions about what to implement in the rule. We the purpose of the forum was not to rehash the cluster rule debate, company executives saw an opportunity to extend the time horizons of all stakeholders. Perhaps EPA could be swayed to consider creative alternatives to a tough rule.

Regardless of the impact on the cluster rule, the forum could broaden the debate about future environmental regulation. There were several issues that would certainly drive the future direction of U.S. chlorine regulation and environmental performance of U.S. pulp and paper companies:

Evolution of scientific assessment of organochlorines, including dioxin: Given significant resources dedicated to the study of chlorine, scientific understanding would surely evolve. How would this new knowledge likely change regulatory and corporate strategy? If new scientific information was presented about chlorine or other environmental issues, how swiftly would companies and regulators be expected to change behavior? If companies were forced to invest in technologies that quickly became outdated by new scientific information, how would the blows to their competitive positions be softened?

Evolution of chlorine strategies in international markets: Since U.S. companies were effective competitors internationally, they saw regulation as one source of competitive advantage or disadvantage. To date, they had invested significantly in environmental controls. If major changes were made to performance standards, companies argued, previous environmental investments would be “forsaken” and relative competitiveness hampered. How would other countries regulate chlorine, and when?

Development of bleaching alternatives to chlorine: Even as the cluster rule was being finalized, alternatives to substitution and oxygen delignification were emerging. First, there was ozone bleaching. Ozone bleaching substituted ozone for chlorine or chlorine dioxide in the first bleaching step of the kraft pulping process. The use of ozone could reduce but not completely replace chlorine compounds for bleaching. Since only one mill was operating a proprietary ozone bleaching process in 1994, most industry experts considered the technology unproven. Ozone bleaching reportedly raised capital costs while reducing operating costs significantly.

Second, there was TCF. TCF processes required the use of either oxygen or ozone delignification (highest level ECF), and the conversion of the final bleaching step from chlorine dioxide to hydrogen peroxide. Choosing TCF not only reduced total effluent, it also reduced water usage. The final product from TCF was clearly less bright than levels achieved through chlorine bleaching, but markets might change to support the use of such a product. Further technological advances would likely shrink the brightness gap as well. The total investment cost for a TCF line was estimated at $75 million. In 1994, there were about 35 facilities operating with TCF worldwide; only one of these facilities was based in the United States. The difference in wood supply was one reason that European producers had more readily converted to TCF, claimed U.S. industry experts.

Finally, there was totally effluent-free (TEF). TEF processes were not a reality in 1994. Still, some industry leaders envisioned a system in which materials could continue to be recovered and used in a closed-loop process. At what pace would these new technologies emerge? Who would pay for such development? Would such research be undertaken individually or collaboratively?
Development of markets for non-bleached paper products: it was unclear whether and when consumers would drive the expansion of an ECF or TCF market. Most research indicated that U.S. consumers were unwilling (perhaps even less willing than five years ago) to pay more for a product considered to have environmental attributes superior to competitors. If market demand forces were expected to outpace regulatory forces, how would this market be developed?

STAKEHOLDERS

Greenpeace

Greenpeace was a grass-roots non-profit organization established in 1971 that had been involved in many areas of environmental advocacy, including protests against whaling, harp seal hunting, rainforest logging, French nuclear testing in the South Pacific, and industrial pollution.

Greenpeace had been a major force in shaping public debate on chlorine. In 1987, Greenpeace learned that the EPA had found dioxin in fish collected downstream from paper mills in Maine and Wisconsin two years earlier. In response, Greenpeace published a report entitled “No Margin of Safety” which alleged that both the paper industry and the EPA had engaged in a cover-up of the dioxin releases. Upon further investigation, Greenpeace learned that dioxins were associated with bleached pulp, and were likely present in numerous household products, including tissues, coffee filters, kitchen towels, and diapers.

Since 1987, Greenpeace had pressured the EPA to stop releases of dioxins to the environment. Its approach on dioxin was part of a broader campaign to eliminate chlorine from all industrial production. Staff members suggested that they would not compromise with the pulp and paper industry on the use of chlorine or chlorine-based compounds. In recent years, Greenpeace’s position, once considered radical even within the environmental community, was becoming more accepted. The Natural Resources Defense Council (NRDC), the Environmental Defense Fund (EDF), and numerous other well-respected environmental groups had begun to support similar positions on chlorine during 1994.

The pulp and paper industry had attacked Greenpeace’s position on the grounds that both scientific proof for chlorine elimination and market demand for TCF products were lacking. Greenpeace unhesitatingly pointed to Europe and claimed that an American market would develop once U.S. paper makers began to manufacture chlorine-free paper products. In July 1994, Greenpeace activists scaled the Ti - Life building in New York City. They called attention to the reluctance of Time magazine to use TCF paper in its product. Time had allegedly argued that they could not obtain a satisfactory supply of high-quality TCF paper. The public protest afforded an opportunity for Greenpeace to circulate a mock edition of Time produced on TCF paper.

While not entirely unwilling to consider novel collaborations with traditional enemies, Greenpeace was concerned about how their traditional constituents might perceive any cooperation with businesses or agency leaders.

US. Environmental Protection Agency (EPA)

EPA, charged with the protection of human health and the environment, was the federal agency responsible for developing and implementing the proposed cluster rule. EPA was basing the proposed rule on extensive study of the pulp and paper industry’s processes, manufacturing and pollution control technologies, and economics. A draft of the cluster rule was made public in November 1993. EPA sought public comment from any and all interested parties.

Exercise 4: Chlorine and the Paper Industry
from November 1993 until April 1994. EPA would have to reconcile the public comments with the proposed rule and make any necessary changes before publishing the final rule in 1995.

EPA had been experiencing pressure from almost all sides. Paper companies had attacked EPA for establishing an allowable limit for dioxin emissions below 10 parts per quadrillion (ppq), a level they claimed was unmeasurable using current technologies. To respond to business, EPA was considering technology guidelines rather than technology standards so that companies could choose their own optimal technology response. Politicians had attacked EPA for its bureaucratic tendencies and unnecessary burdening of productive industries. Such pressure had resulted in the new Executive Order mandating that the agency consider costs and benefits in developing regulations. Not surprisingly, the pulp and paper industry believed that EPA had grossly overstated the benefits of chlorine reductions while severely understating the costs. Environmental groups were chasing EPA as well. Sitting atop a preponderance of scientific data about chlorine, EPA was hesitating to use its authority under the Clean Water Act to ban chlorine bleaching in the interests of public health. Beleaguered by these pressures, yet constrained by legislative mandates, EPA was open to new ideas that would help it to move forward.

Pulp and Paper Companies

The companies involved in the forum could be placed into three company types, described below as Alpha Company, Beta Company and Gamma Company.

Alpha Company: This company was recognized as an industry leader in the environmental arena. Alpha had invested heavily in research and development of chlorine bleaching processes and had developed an ozone bleaching process which it was demonstrating at one of its plants. Alpha was often singled out by environmental groups and regulatory agencies as proof that the cluster rule was both feasible and affordable. Significantly, the plant in which Alpha used its ozone technology produced fine writing papers, the plant was considered to be one of the most profitable in the industry, and had been for 20 years.

Alpha management had been pleased with the results of switching to the ozone process, although it had taken longer than expected to implement the technology. Alpha had realized operational cost savings as a result of the change to the ozone process. The process was essentially a closed loop that reused many of the chemicals involved in the pulping process. Alpha had formed a separate division to market its ozone technology to the industry as a whole, and the technology was available for a substantial licensing fee. Alpha operated a second bleached kraft plant that did not yet employ the ozone process. It did use extended cooking, oxygen delignification, and chlorine dioxide substitution. It had been deemed the second best plant in environmental performance in the industry, according to one environmental award received: the plant with ozone bleaching was rated as the best.

Since Alpha’s ozone bleaching process still used chlorine dioxide in the final phase, it was not considered to be TCF. If other companies chose to acquire Alpha’s technology, they would incur a substantial initial investment cost and would easily exceed the standards in the proposed cluster rule. This system could be upgraded later to create a TCF process with relatively minor modifications and at a low cost. Only the portion of the investment expended for chlorine dioxide production would be wasted if a company later decided to move up to a TCF standard.

Stakeholder Negotiations: Exercises in Sustainable Development
**Beta Company:** Beta operated three bleached kraft plants in the southeastern U.S. that were of average profitability when compared to the industry as a whole. The plants, which produced a range of paper products, were medium-sized. One plant was new, while the other two were beyond their economic life and required upgrading for competitive purposes. The company had committed to upgrading production lines at these two plants to a standard that would meet the proposed cluster rule.

If stringent AOX standards were imposed, as expected, management’s first choice was to employ oxygen delignification and two chlorine dioxide stages (like Plant Two of Alpha Company). Alternatively, Beta could license the ozone technology from Alpha Company; doing so would position it for TCF capability in the future but it would require greater capital costs. In its newest mill, Beta had already substituted a chlorine dioxide stage for elemental chlorine, in addition to using extended cooking. This plant would meet the proposed cluster rule, but would require substantial modification and investment to become TCF.

**Gamma Company:** Gamma was an industry leader in sales and produced a wide range of products, including fine papers. Gamma was viewed by many in the industry as an extremist, a position adopted primarily because of their paper division’s extremely poor financial condition. Gamma had been acquired in a leveraged buy-out in the 1980s and was saddled with an extremely high debt burden. Gamma was facing extensive litigation relating to alleged releases of dioxins from three of its bleached paper plants. Although none of the cases had yet gone to trial, suits totaling over $9 billion dollars in damages had been filed by 1994. Gamma was also involved in the investigation and cleanup of environmental contamination — under the supervision of federal and state regulatory agencies — at several of its facilities. None of Gamma’s plants were at or near the end of their useful lives.

Four of the plants used traditional chemical pulping methods (no oxygen delignification; no extended cooking), while the other seven plants had been adapted by substituting chlorine dioxide for elemental chlorine, a change that significantly reduced the formation of dioxins to concentrations near currently available detection limits, but not to the levels expected in the proposed cluster rule. Gamma had challenged the scientific basis of the cluster rule, specifically EPA’s ability to measure accurately dioxin discharges on the parts per quintillion level. Gamma believed there was a middle ground — ECF using chlorine dioxide substitution for chlorine — that would help the environment without crippling the industry.

**THE TASK.**

You are a senior executive of one of the stakeholder teams that will attend the “Forum on the Environmental Future of the Pulp and Paper Industry.” You will receive a schedule outlining the tasks assigned to your team. They will include the following types of activities:

- development of a strategy regarding the future regulation of chlorine in the industry
- preparation of information you would like to share with other stakeholders
- identification of information you would like to receive from other stakeholders
- development of a presentation you will make to the other teams, including proposals for compromise and/or collective action
- preparation of a briefing you will make to your board of directors and senior executives

If you are on a company team, you will be
assigned to either Alpha, Beta, or Gamma company. The forum might include more than one group representing Alpha, Beta, or Gamma, depending on class size. Teams of the same type may adopt different positions.

Paper company executives should think carefully about the following:

- What are the best short-term and long-term chlorine strategies for your company?
- What are desirable strategies for the companies collectively?
- What is the best approach to learn from and influence Greenpeace and EPA? Where, if at all, is there possible cooperation?

EPA executives should consider:

- What outcome would you like the companies to achieve at the forum and what can the EPA do to facilitate that outcome?
- How might this process inform the cluster rule and future regulatory initiatives?
- How would EPA like to operate in the future, given the state of scientific knowledge and the economic capabilities of the companies?

Greenpeace executives should consider:

- How might you facilitate a positive outcome at the Forum?
- Can you collaborate with the other teams and still maintain your strong voice for change?
- What will you offer in return for concessions by paper companies?

This was an exciting time for senior managers in the companies, Greenpeace, and EPA. A cluster rule would be issued within nine months. More important, the various stakeholders stood on the threshold of a new era in environmental management. This new era invited collaboration and consultation among stakeholders. While chlorine was just one environmental issue in the paper industry, it was an important issue, and it offered a window of opportunity to improve the environment in ways that were responsible for all stakeholders.
APPENDIX A: THE PROPOSED CLUSTER RULE

Regulatory Mission and Authority Congress requires the United States Environmental Protection Agency (EPA) to regulate discharges to the air and water and has provided EPA with specific legislation to do so. Under the Clean Water Act, EPA is tasked to develop effluent guidelines for major industries. These guidelines, which are subject to periodic review and revision as technology improves, are then used to establish discharge limits for specific facilities that discharge to surface waters or municipal sewage treatment systems (Publicly Owned Treatment Works, or POTWs). Under the Clean Air Act, EPA is tasked to develop emission standards for major sources of specified air pollutants.

Development of the Integrated Regulations In March 1985, the Environmental Defense Fund and the National Wildlife Federation sued the EPA regarding the regulation of dioxins and furans produced by paper mills. In settlement of this lawsuit, the EPA entered into a consent decree with the parties in July 1988. The consent decree required EPA to: (1) address discharges of dioxin and furans, which are known carcinogens, by proposing effluent limitations for 104 bleaching pulp and paper mills by October 31, 1993; (2) develop regulations governing discharges of dioxins and furans from these mills within 18 months of the date of the integrated rule’s proposal; and (3) conduct a multiple pathway risk assessment of sludges, water effluent, and products made from pulp produced at the 104 mills studied in the USEPA/Industry Cooperative Dioxin Study.

From September 1992 to June 1993, EPA developed integrated regulations through an open process involving meetings with environmental groups, pulp and paper industry companies, and other interested parties. EPA also solicited public comment on the proposed regulations. The integrated discharge regulations for the pulp and paper industry, known informally as “the cluster rule,” were formally proposed in November 1993. A public comment period ended in April 1994. EPA has, since April 1994, reviewed the proposed regulations in light of the public comments received. In 1995, EPA will issue the final version of the cluster rule, and the industry will have three years to come into compliance with the new regulations.

The cluster rule represents the first time EPA has proposed a comprehensive regulation for one industry that includes guidelines and standards controlling the release of pollutants to water and air. EPA believes an integrated approach will provide greater protection of human health and the environment and will also reduce pollution control compliance costs by increasing the pulp and paper industry’s ability to plan more effective compliance strategies. EPA believes the proposed rule will significantly reduce the amount of pollution entering the environment. This reduction will be achieved by using: (1) technologies that prevent the creation of certain pollutants; (2) technologies that better control the discharge of pollutants that are created; and (3) by imposing facility-specific “housekeeping” requirements.

There has been great debate about and much disagreement with the proposed regulations. Greenpeace believes that the proposed cluster rule does not go far enough in addressing and correcting environmental contamination. AF&PA and many of its member firms believe that the regulations will impose an extreme financial burden on them at a time when the industry is in a slump.

Some companies are concerned about the time element of the cluster rule, believing that EPA’s three-year compliance window is simply unrealistic. Industry advocates argue

Exercise 4: Chlorine and the Paper Industry
that there are simply not enough vendors to supply all of the companies in the industry with the appropriate technology to meet the proposed rule. Industry is also concerned that technology vendors will take advantage of the demand for their products and services by raising prices, which will further hurt the industry financially. Some company executives believe that they will be faced with either going along with price-gouging or shutting down their plants (and losing substantial revenues) until some future date when the supply of technology has increased and prices have dropped. Given the current availability of technology, industry estimates that at least six years are required for the industry to come into compliance with the proposed rule. Their estimated costs of complying with the current version of the proposed cluster rule are triple the estimates of EPA. Executives believe that tax incentives are needed to mitigate the financial impact of compliance.

Water Releases
One of the primary aims of the integrated rule is to have the pulp and paper industry employ technologies that either prevent or reduce the formation of dioxins and furans in effluent. In the integrated rule, EPA proposed effluent limitations, under the authority of the Clean Water Act, intended to control discharges of toxic, conventional, and nonconventional pollutants from existing or new facilities. The regulations apply to facilities that discharge waste water either directly to surface water or to a municipal sewage treatment system. All mills in the United States that produce pulp, paper, or paperboard as a final product are governed by this section of the regulation. For purposes of classification and regulation, EPA had previously divided the industry into over 20 subcategories based on the process used and the product produced; the number of subcategories has been reduced to 12 in the proposed regulation.

The Clean Water Act uses technology-based effluent guidelines and water-quality-based controls to protect water resources. The technology-based effluent guidelines establish nationwide, industry-specific limits on conventional, toxic, and non-conventional pollutants discharged by the pulp and paper industry. The pollutant levels contained in the technology guidelines are based on the best technology that is economically achievable by the industry being regulated. EPA developed the technology-based guidelines after performing an extensive study of the industry and the available technologies, conducting extensive wastewater sampling to determine the types and quantities of pollutants discharged, and calculating the financial impact of the proposed guideline. In the event that more stringent measures are needed to protect water quality in specific areas, individual states can develop water-quality-based controls for specific watersheds.

The changes in the effluent limitation guidelines resulting from the adoption of the integrated rule can be categorized by pollutant type as summarized below:

**Effluent Guidelines: Conventional Pollutants**
For all 12 subcategories of the industry, limitations are set on conventional pollutants, including biochemical oxygen demand and total suspended solids. All mills are required to limit conventional pollutants such as BOD and TSS to levels that are equal to the best 50 percent of the mills (in each subcategory).

**Effluent Guidelines: Toxics and Nonconventional Pollutants**
Limitations based on the best technology economically achievable are set on toxic and nonconventional pollutants for the 12 industry subcategories. Limitations on nonconventional pollutants (adsorbable organic halides [AOX], chemical oxygen demand, and color) will apply at the point...
where the effluent is discharged from the mill property. Limitations on toxic pollutants (chloroform, methylene chloride, and some chlorinated phenolic compounds) will be set in the bleach plants, which are located inside mill areas. Effluent limitations for chlorinated dioxins and furans, which are toxic pollutants, are included in the regulations for four of the subcategories; the limitations for these two pollutants are on the end-of-pipe effluent at the point where it is discharged from the property. Mills that use chemicals in the pulping area will also be required to implement spill prevention and containment procedures.

Some industry representatives have challenged EPA's ability to measure reliably dioxin concentrations at the parts per quadrillion level, the standard specified in the proposed rule. In calculating the total quantity of dioxin discharged from U.S. mills, which in 1993 was estimated at 11 ounces, these industry analysts routinely assume that nondetect samples contained dioxin at a concentration equal to 50% of the detection limit. Many of the nondetect samples may have, in fact, contained no dioxin at all, and these analysts believe that their calculations of total annual dioxin discharge are extremely conservative and err greatly on the side of human health and the environment. They also point out that, as an industry, they are far from the largest discharger of dioxins and furans in the United States.

**Effluent Guidelines: Pollution Prevention**

Toxic compound effluent limitations are based on process changes in the bleaching and pulping areas of the mills. Pulping area changes include greater uniformity of wood chips and better pre-bleaching pulp washing. These changes will reduce the amount of bleaching chemicals required. Changes in the bleaching area will also occur, including oxygen-based removal of lignin from the washed pulp (oxygen delignification) and partial or total substitution of chlorine dioxide for elemental chlorine with other chlorinated chemicals, which would reduce the amount of dioxins, furans, chlorinated phenolics, and other compounds in effluent discharges.

**Costs and Benefits of Integrated Rule**

EPA believes most companies will find it both possible and affordable to comply with the proposed rule. EPA estimates the total annualized cost to industry will be $600 million, and the total capital investment cost (including the purchase price of the capital equipment and installation services) needed to meet the proposed standards will be approximately $4 billion. (Operation and maintenance costs for the installed capital equipment are estimated by EPA at $400 million per year). However, EPA acknowledges that compliance costs could result in closure of 11 to 13 plants (5% of total plants) and the loss of between 2,800 to 10,700 (<1%-4% of total jobs). Consumers will not be influenced greatly, with the greatest market price change (3% increase) occurring in uncoated free sheet paper (copy and tablet paper).

The industry disputes EPA's calculation of the financial impact of the proposed cluster rule. AF&PA estimates that the total cost of compliance with the proposed rule will be closer to $10 billion. They believe the rule will result in the closure of more than 33 mills and a total of 107,500 job losses, including 21,500 direct mill jobs and 86,000 indirect jobs.

**Exercise 4: Chlorine and the Paper Industry**
used to make cardboard, printing paper, tissues, food additives, cellophane, and rayon.

Chem-o-Thermo Mechanical Pulping (CTMP): This process involves chemical pretreatment (with sulfur-based chemicals) and vapor/steam heating of the wood chips prior to grinding. This produces pulp suitable for use in both low-grade (hygiene products) and high-grade (coated and writing-grade papers) products. CTMP is used both for softwoods and hardwoods. Environmental releases from this process include the sulfur compounds used to pretreat the wood chips. These sulfur compounds, combined with releases of natural wood chemicals, make CTMP effluent highly toxic to fish and slow to degrade in the environment.

The two primary chemical pulping methods are kraft pulping and sulfite pulping. In kraft pulping, wood chips are boiled with caustic soda, which efficiently removes lignin and resins from softwoods and produces a dark-brown, strong pulp. Kraft pulping is a closed loop system, since nearly all of the pulping chemicals are recovered. Wood wastes are incinerated, providing energy to run the pulping operation. Some waste materials — including sulfur dioxide (to the air) and cellulose fibers (in the water) — are released to the environment. If the kraft pulp were to be used to produce white paper, it is bleached using one of many methods. It is the bleaching step that produces the contaminants of concern — including dioxins, furans, and other organochlorines — to environmental groups and the EPA.

Sulfite pulping, the other primary chemical pulping process, involves boiling wood chips in sulfuric acid. Sulfite pulp, often used in making tissue products, is lighter-colored, weaker, and softer than kraft pulp. Sulfite pulping can also be a closed loop, but chemical recovery is less efficient than in kraft pulping. Sulfite pulping also releases sulfur dioxide to the air. Typically, sulfite
pulping requires 35,000-40,000 gallons of water per ton of bleached pulp whereas mechanical pulping uses only 10,000-15,000 gallons per ton.

Conventional bleaching technology for chemical pulp typically used chlorine gas to degrade and remove the lignin, 5 to 10 percent of which remained in the pulp after the chemical pulping phase. Hypochlorite or chlorine dioxide gas was then used to bleach the pulp white in a several stage process. The average ton of conventionally bleached kraft pulp required anywhere from 110 to 176 pounds of chlorine per ton. A portion (10%) of this chlorine combined with the organic molecules to form compounds known as organochlorines. These compounds were then discharged as part of the mill effluent.

After the pulp had been bleached, it was ready to be used in papermaking. The pulp could be dried and shipped to a paper mill, or sent wet directly to a paper machine in an integrated plant.
NOTES


3 In fact, by the signing of Executive Order 12873, the U.S. government had established a new standard of 50% waste paper content, including 20% post-consumer material for its paper purchases by 1995, with a goal of 30% post-consumer content by 1999. While government procurement did not force other buyers to change behavior, it was considered an indicator that others often voluntarily followed.

4 Michael Baram, Patricia Dillon, and Betsy Ruffle, Managing Chemical Risks: Corporate Response to SARA Title III, Center for Environmental Management, Tufts University, May 1990.


7 Bette Hillman, op.cit.


Pulp and Paper

The pulp and paper industry is the world's second largest consumer of chlorine and the greatest source of toxic discharges directly into water. Although scores of mills across the world are now producing bright paper using totally chlorine-free technology, many of the world's producers have yet to switch. With safe and effective alternatives now available for this industry, the phase-out of marine-based chemicals from pulp and paper mills should be immediately.

At first glance, a sheet of paper might seem harmless, especially compared to the many chemical pesticides, plastics, and other products on the market today. But a closer look at paper production reveals toxic chlorine bleaching and reckless logging practices that are devastating our forests, our rivers and lakes, and our health.

Of particular concern are the huge quantities of toxic organochlorines by-products from the use of chlorine bleaches that the world's paper industry releases into the air, the water, and paper products themselves. These chemicals, including dioxin and thousands of other substances, are building up in the global environment, the food chain, and the bodies of the human population and are implicated in local and global outbreaks of cancer, impaired reproduction and development, immune suppression, and other diseases.

This information is printed with the permission of Greenpeace. Copyright © Greenpeace.

Exercise 4: Chlorine and the Paper Industry
TOXIC ORGANOCHLORINE DISCHARGES

The paper industry is the world's second largest consumer of chlorine, using about 3 million tonnes each year to bleach wood pulp bright white. (1) Chlorine is used in a number of different forms: as elemental chlorine gas (Cl2), chlorine dioxide (ClO2) or sodium hypochlorite (NaOCl). All result in the discharge of toxic organochlorine by products.

Because chlorine is extremely reactive, it combines quickly with the organic matter in the pulp to produce thousands of new chemicals called organochlorines. An average sized conventional pulp mill discharges around 35 tonnes of organochlorines every day, while those that use chlorine dioxide discharge 10 to 20 tonnes per day.

The paper industry is the largest source of organochlorine releases directly into the world's waterways, discharging 2 million tonnes of organochlorines each year. (2) Pulp mills in Sweden and Canada appear to be responsible for as much as 90 percent of all organochlorines discharged directly into the Baltic Sea and the Great Lakes. (3,4)

Over 300 organochlorines have been identified in the discharges of bleached pulp mills, including dioxins, furans, chlorinated phenols, acids, benzenes, and many others. (5) These identified compounds account for less than 10 percent of all the organochlorines in the effluent; the majority remain 'mystery' chemicals that have not been specifically identified or assessed. Many of these are large, complex organochlorines that tend to persist in the environment in more persistent and toxic compounds. (5)

Many organochlorines resist natural breakdown processes, so they build up over time in the environment. (4) Further, many organochlorines concentrate in the tissues of living things and are magnified as they move up the food chain. Predator fish and other species near pulp mills have been found to accumulate dioxins and other organochlorines at concentrations thousands or even millions of times greater than the levels found in the water itself. (4)

Paper mills also release organochlorines into the air, particularly chlorofluorocarbons (CFCs), a cause of the 'greenhouse effect.' Worldwide emissions of chlorofluorocarbons from the paper industry are estimated at 30,000 tonnes per year. (6)

Organochlorines are also found in the sludge produced at pulp mills. Accounting for as much as 4 percent of the total weight of the material, contaminated sludge is spread on the land, buried in landfills, or incinerated, releasing chlorinated by-products into the air including PCBs and dioxins. (7) In forests where pulp mill sludge has been disposed, dioxins have accumulated in the tissues of field animals and caused health effects in birds. (8)

Finally, organochlorines are found in paper products. Environment Canada estimates that 2 percent of the organochlorines found in the bleaching process remain in the pulp. (5) Based on this figure, about 60,000 tonnes of these chemicals are used up in paper products each year. Dioxins and furans have been identified in cigarette paper, tampons, diapers, tissues, coffee filters and bleached milk cartons. (9) Bleached containers and filters can leach dioxins into milk, coffee, and other foods with which they come in contact. (10)

HARMING HEALTH AND THE ENVIRONMENT

There is extensive evidence that effluent from chlorine-bleaching pulp mills harms fish and aquatic ecosystems. Pulp mill discharges -- and organochlorines in particular -- have been linked to physical deformities in fish, reduced gonadal growth, hormonal changes and reproductive impairment, liver disorders, disruption of cell function, changes in blood composition, damage to skin and gills, changes in swimming behaviour and changes in the structure of fish populations. Organochlorine discharges from pulp mills have also damaged fish habitats injured aquatic plant colonies, and caused harm to benthic and brackish organisms. (11)

Effects on fish have been recorded as far as 40 kilometers (25 miles) away from the pulp mill discharge point. (11) An extensive study by the Swedish EPA was unable to determine any safe exposure level to organochlorine discharges from pulp mills, concluding that regional and possibly large-scale damage to fish and the aquatic foodchain may be occurring throughout the Baltic ecosystem. (11) Organochlorine contamination of the Pea Lake food chain has also been linked to

CHLORINE DIOXIDE: GOING ONLY HALFWAY

Many pulp makers have tried to avoid investing in chlorine-free technology by switching from chlorine gas to chlorine dioxide bleach. But chlorine dioxide still results in the production and release of large quantities of organochlorines, though less than chlorine gas. With an effective alternative available that can reduce the problem completely, there is no good reason to go on halfway.

A complete switch from chlorine to chlorine dioxide can reduce organochlorines by up to 80 percent. Even if all the world's pulp mills were converted to chlorine dioxide and equipped with state-of-the-art pollution control equipment, however, the paper industry would still discharge at least 140,000 tonnes per year of organochlorines into waterways, plus additional organochlorines to sea, land, and products, based on the industry's own estimates. (23) These effluents would contain about 20,000 tonnes per year of very persistent and biaccumulative compounds such as dioxins, furans and chlorophenols. (24)

Chlorine dioxide effluents also contain chloroform, chlorinated alcohols, and other toxic compounds that can be taken up into the tissues of fish. (25) Further, chlorine dioxide is being used to produce large amounts of chlorine, a powerful herbicide that kills both plants and fish. (4,5) Finally, the vast majority of the organochlorines found in these effluents have not been specifically identified or assessed. (25)

The environmental and economic benefits of a closed-loop system are not available to mills that use chlorine dioxide, because of the presence of corrosive chlorination by-products in the effluents. Only at great expense can effluents from such mills be recycled; even then, organochlorine contaminants must be removed and incinerated, resulting in their dispersion into the air. (25)

An extensive research program by the Swedish Environmental Protection Agency concluded that effluents from pulp mills using chlorine dioxide continue to damage aquatic ecosystems, though with less severity than mills that use chlorine gas. The more chlorine used, the more severe the effects, these studies found. Chlorine dioxide does less damage to aquatic ecosystems than pure chlorine, but chlorine-free mills cause the least injury of all. (11)
Organochlorines found in pulp mill effluent can harm human health as well as the bodies' hormones and cause infertility, impaired development, immune suppression, and cancer. According to EPA scientists, levels of dioxin currently found in the tissues of the general human population are already high enough to cause these effects. (11) Fish and marine mammals, too, are very susceptible to dioxin's effects on reproduction and development. (16)

Each year, the world's paper industry discharges from 850 to 3200 tons of ‘dioxin equivalents’ into waste sludge and paper products, based on U.S. EPA figures. (17) This quantity is equal to the amount of dioxin that can cause 57,000 to 265,000 cases of cancer each year, according to EPA cancer estimates. (18)

Already, dioxin contamination has forced the closure of fishing grounds around eleven of the fourteen pulp plants on the British Columbia coast, where extremely high dioxin concentrations were found in crabs, mussels, and the liver tissue of fish. In 1994, the Maine Department of Health recommended that children and pregnant women not eat local or women not eat local ortoxic fish due to dioxin contamination caused primarily by the state's 7 chlorine-bleaching pulp mills.

### TOWARDS A CLEAN PULP AND PAPER INDUSTRY

Chlorine-free bleaching technology for pulp and paper companies: 55 mills now producing totally chlorine-free, high-quality bleached pulp.

- **Province of Ontario**: Pulp mills must eliminate organochlorine discharges by 2002.
- **British Columbia**: Pulp mills must eliminate organochlorine discharges by 2002.
- **Sweden National**: Goal to end toxic discharges by 2002.
- **International Joint Commission on the Great Lakes**: Calls on U.S. and Canada to phase out uses of chlorine as an industrial feedstock.
- **Paris Commission**: 13 nations on the North Atlantic and the EU agree to eliminate persistent, toxic discharges of bioaccumulative substances, particularly organochlorines.
- **Barcelona Commision**: 21 Mediterranean nations agree to eliminate persistent, toxic discharges of bioaccumulative substances, particularly organochlorines.

### Action Towards a Clean Pulp and Paper Industry

**Some paper companies**: 55 mills now producing totally chlorine-free, high-quality bleached pulp.

**Provincial Government**: Pulp mills must eliminate organochlorine discharges by 2002.

**International Joint Commission on the Great Lakes**: Calls on U.S. and Canada to phase out uses of chlorine as an industrial feedstock.

**Paris Commission**: 13 nations on the North Atlantic and the EU agree to eliminate persistent, toxic discharges of bioaccumulative substances, particularly organochlorines.

**Barcelona Commission**: 21 Mediterranean nations agree to eliminate persistent, toxic discharges of bioaccumulative substances, particularly organochlorines.

**American Public Health Association**: Calls for "measurable and progressive reductions toward the elimination of the use of chlorine-based bleaches in the pulp and paper industry.*"
REFERENCES


2. Assuming 1.8 kg of organically-bound halogenated (ABX) per ton of pulp in U.S. EPA Effluent Limitations Guidelines for Pretreatment Standards and New Source Performance Standards: Pulp, Paper and Paperboard Category (1993) world production of 100 million tonnes of bleached pulp per year and 1.8 kg of organochlorines for each kilogram of halide measured as ADK. See Barbor (19895). 


17. Based on U.S. EPA's current cancer potency estimate for 2,3,7,8-TCDD of 0.0003 kg/kg/1 year. Assuming a 70 kg person with a 70 year lifetime. C. U.S. EPA (1985). Health Assessment Document for Polychlorinated Biphenyls. Office of Health and Environmental Assessment. EPA/600/84/141. Of course, not all dioxin released will immediately result in human exposure. This figure is not a risk characterization but a qualitative discharge in toxicological perspective.


24. Assuming a 0.1 kg ratio of extractable organically-bound chlorine (EDC) to total organically-bound halide (ADK) in effluents from mills using 100% chlorine dioxide. See Solomon (23).


WHAT YOU CAN DO

Demand that governments develop regulations and incentives to eliminate the use of chlorine and chlorine-based bleaches in the pulp and paper industries within 5 years.

Pressure large paper users — publishers, magazines, printing and copy companies, and governments — to use chlorine-free paper.

As a consumer, use less, recycle more and buy chlorine-free, or 100% recycled (using post-consumer waste) paper products that have not been deinked or re-bleached.
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 S22 billion per year. These costs are much lower than the savings associated with phasing-out chlorine, with initial estimates beginning at S80 to S160 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 S50 to S100 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.

This information is printed with the permission of Greenpeace and is excerpted from “Transition Planning for the Chlorine Phase-out: Economic Benefits, Costs, and Opportunities.” Copyright © Greenpeace 1994.

Exercise 4: Chlorine and the Paper Industry
• 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 convening 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. EPX 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 $45 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.

**Exercise 4: Chlorine and the Paper Industry**
through the chlor-alkali process. Chlor-alkali plants should no longer be allowed to purchase 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.

*Stakeholder Negotiations: Exercises in Sustainable Development*
The Right Balance —
Environmental Responsibility and
the Competitive Edge

Clifford T. Howlett, Jr.
Vice President, Government Affairs
Georgia-Pacific Corporation
Atlanta, Georgia

The pulp and paper industry in the United States has invested billions of dollars over the last 20 years to meet standards set by the Clean Air and Clean Water acts as well as hazardous waste laws. Our air, water, and land are cleaner now as a result. But groups outside the industry are pushing us to implement even more drastic environmental actions that provide little or no benefit to human health or the environment beyond the significant benefits we have already achieved. Nevertheless, these ideas have the capacity to fundamentally affect the competitive structure of the industry worldwide. Three key issues dominate: first, what do we mean by chlorine-free? Second, what is the industry being asked to reduce, and what benefits will be gained? Third, and finally, what are the economic impacts of these changes?

Pollution Prevention Progress

Let's consider the progress this industry has made in pollution prevention. Today, U.S. mills are already meeting effluent pollutant discharge levels that are targeted for 1995 by other paper-producing nations. Our industry uses 60 percent less water per ton of product than it did just over two decades ago. Since the Clean Water Act's implementation, the total biological oxygen demand (BOD) of industry wastewater has been reduced by 70 percent, while paper production has increased by 50 percent. The pulp and paper industry is among the world's most efficient users of fuel. Through use of waste by-products, our industry produces more than 56 percent of its own energy needs. Over the last two decades, oil consumption has been reduced by more than 60 percent, and fossil fuel and energy consumption per ton of paper have been reduced by almost 50 percent. To put that in perspective, because our industry cogenerates more than 50 percent of its electricity needs, we save 24 million barrels of oil annually. Industry air pollution control technologies now remove more than 97 percent of the particles generated in the pulp and papermaking process. Virtually every new solid fuel boiler and piece of process equipment achieve a particle removal rate of almost 100 percent.

The U.S. pulp and paper industry is the world's largest paper recycler, recovering almost 31 million tons of paper for reuse last year. We have set a goal of 40 percent recovery by 1995.

On the resource side, last year the U.S. forest products industry planted nearly 1.7 billion seedlings. Twenty percent more forested timberland exists today than 20 years ago. Georgia-Pacific and other U.S. pulp and paper manufacturers are also participating in U.S. Environmental Protection Agency's voluntary 33/50 pollution prevention program. in fact, the industry has already realized EPA's goal for lowering dioxin discharges, reducing them by 80 percent. Georgia-Pacific's dioxin discharge is now below 10 parts per billion. These efforts have resulted in measurable levels of dioxin in 9 of our 10 bleached mill effluents. We have committed the capital to achieve this nonmeasurable result at the remaining mill, which even now meets its state's dioxin water quality standard. We are well on the way to meeting the other pollution reduction goals for the 33/50 program (see Fig. 1).

The U.S. industry recently adopted its own set of environmental, health and safety, and forestry principles that formalize our commitment to a


Exercise 4: Chlorine and the Paper Industry
healthy environment. With these accomplishments and ongoing initiatives, I believe the U.S. pulp and paper industry is meeting the pollution prevention challenge.

Let's put these efforts into perspective. As Figure 2 illustrates, the industry contributes about 0.25 percent to this country's Gross National Product, and yet, we account for nearly 2.5 percent of total U.S. industry expenditures on pollution control. Certain environmental factions, however, do not believe that this is enough. They believe that whatever industry does, it will never be enough to safeguard public health and the environment. That attitude has led us to a critical juncture in the history of the pulp and paper industry — specifically the heated debate about the use of chlorine compounds to bleach pulp and paper products.

**Defining Chlorine-free**

Does chlorine-free mean reducing or eliminating the use of chlorine gas with chlorine dioxide substitution? Do we measure success in the reduction of chlorinated organics of concern? Or do we mean the use of no molecular or elemental chlorine anywhere in the manufacturing process? The answer is that trying to make the world chlorine-free, as some organizations would like, is impossible because nature is replete with chlorinated organics. As reported by the Swedish Environmental Protection Agency, more than 220 million tons of chlorinated organic compounds — nearly 3,000 times the amount discharged by the U.S. paper industry — are produced naturally by marine organisms in the Atlantic Ocean each year.

The next question we must answer is, “What is the industry being asked to reduce, and what benefits will be gained?” Most environmental groups are stressing the elimination of bioaccumulative chlorinated organics. Are they talking about dichlorodiphenyltrichloroethane (DDT)? It's not produced by the pulp and paper industry. Polychlorinated biphenyls (PCBs)? Not us, either. Dioxin? The U.S. pulp and paper industry has virtually eliminated the problem. In fact, pollution control measures in the United States have already led to substantial reductions in all chlorinated organics. All chlorinated organics are not created equal. Most are benign, although a few may be toxic, including some of those produced naturally. Only a tiny fraction of all chlorinated organics are generated by human activity. At a typical pulp mill, 90 percent of the chlorine used in the bleaching process ends up as common salt, while the remaining 10 percent combines with the various constituents to form chlorinated organics — 99.96 percent of which are benign.

To put exposure levels into some perspective: based on current available scientific information used to determine the “no observable adverse effect level” (NOAEL), the concentrations of each chlorinated organic, when present in mill effluent, are below the NOAEL for these compounds.

The EPA effluent guideline program focuses on 28 chlorinated organics that it considers of concern. Only 10 of the 28 are found in bleached pulp mill effluent, and those only occasionally. So using the level of adsorbable organic halogens (AOX) in the effluent as an environmental measure requires caution. AOX is not a reliable indicator of environmental effects because it doesn’t pinpoint the organics of interest. It is a relatively inexpensive analytic chemistry indicator of the presence of all chlorinated organics in the waste stream. AOX also fails to consider issues of equal importance to the...
Comparing U.S. and Other Countries’ Industries

For the last 20 years, the U.S. pulp and paper industry has made substantial capital investments and incurred higher operating costs to meet the environmental challenge. Other countries have not made similar demands on their pulp and paper industry. U.S. environmental investments have achieved a performance level that shows no marked difference between properly treated chlorine-bleached and nonchlorine-bleached effluents. Pulp and paper industries that have not made such investments should not be able to create a climate in which the U.S. industry has to abandon what it has done, in the name of being new and different or politically correct. These new technologies must pass the test of time; they must prove whatever benefits they may offer as the existing technology has done. This leads to my final question — what are the economic impacts of these changes? To put it simply, the economic costs of changing processes are significant for industry and society.

Figure 3 shows the amount of money pulp mills have spent or will spend to go to ever higher levels of chlorine dioxide substitution to achieve specified reduced levels of AOX. The industry today is already in the 1.5 kg AOX per ton of pulp range. Companies have achieved success by foregoing increased production from current capacity. Mills have been forced to use excess recovery boiler capacity to recover solids rather than expand pulp capacity as had been planned. At “no AOX” levels, which means absolutely no molecular or elemental chlorine or chlorine dioxide is used, capital and operating costs are significant factors, but the opportunity cost is equal to the other two combined. The issue is not whether AOX can be removed. It can be if enough time and money are expended. But we have to ask how much is enough when we’re siphoning off scarce capital to install technologies that have little or no environmental benefit — capital that could be used to make our mills more competitive.

In human terms, the impact of AOX reduction on potential jobs is negative. Jobs are displaced because capital that was employed with the expectation that it would yield economic benefit through expansion has now been used for AOX controls. For example, National Economic Research Associates’ figures show that when AOX levels are reduced to 1.5 kg per ton, fewer than 1,500 workers are displaced. At 0.5 kg per ton reductions, up to 5,000 workers lose their jobs; at “no AOX” levels, the number of displaced workers rises to more than 36,000.

Secondary employment is also affected. Jobs in related industries are displaced because of lost actual capacity or potential capacity at local mills — victims of the multiplier effect industry has on the surrounding community. This analysis does not reflect mills operating under high variable cost structures, where adding more environmental control costs to these mills might force them to close. We don’t have any data on the magnitude of such an effect, but it stands to reason that if you run a relatively high-cost mill, it will be noneconomic sooner with additional environmental costs. While other mills will make up the capacity that is lost, a resulting loss in relative worldwide competitiveness will diminish the likelihood that these offsetting capacity additions will occur in the United States.

Diminishing the U.S. Competitive Position

Competitive strength is the final component in our consideration of the economics of these changes —
their effects on the U.S. pulp and paper industry's competitive position. Fortune magazine recently identified this industry as one of the few U.S. industries that is competitive worldwide.

If we have to make process changes that are not warranted by sound scientific evidence, while our competitors in other countries don't, our competitive position will erode. Table 1 shows how much our competitive advantage will decline relative to some of our key competitors should U.S. pulp and paper manufacturers be required to install technologies to eliminate AOX completely. It's important to remember that the United States also imports pulp. As costs of U.S. pulp and paper increase, our domestic markets are more vulnerable to imports.

A cash flow analysis shows the impact on return on investment for a mill with AOX reduction achieved through high chlorine dioxide substitution compared with a mill trying to achieve total AOX removal (see Fig. 4). At the baseline, at a given pulp price, installing equipment to make totally chlorine-free pulp results in a reduction of 60 percent on the mill's rate of return. A 10 percent drop in the price of pulp results in a more than 40 percent reduction in rate of return at the mill that has achieved AOX reduction through high chlorine dioxide substitution versus a drop of 90 percent on rate of return for the mill trying to achieve total AOX removal. At a 13 percent drop in market pulp prices, the total AOX removal mill has no return on investment.

Prices for commodity products such as market pulp have fluctuated within these percentage ranges in recent years, adding to the risk factor for such substantial capital investments. Throughout this debate, we must remember that the marketplace is the key. Traditionally in our marketplace, demand determines the product mix in the marketplace. This supply and demand equation makes the marketplace efficient. Some interested parties see "explosive" growth in markets for TCF pulp. The facts suggest otherwise.

According to Hnwkinr Wright, an independent international consulting firm, TCF pulp currently accounts for less than 1 percent of the world's total

---

**Stakeholder Negotiations: Exercises in Sustainable Development**
pulp production. Several high-cost European sulfite pulp mills have seized the opportunity to establish niche markets in this pulp. These pulp grades are, however, inferior in quality and more expensive than those presently manufactured by the majority of world pulp producers, who utilize kraft pulping technology.

Therefore, we must be wary of attempts by special interest groups to mandate demand for one product over another. This kind of intervention throws the market off and often results in consumers not getting the kind of products they want as well as forcing the market into a high-cost mode.

If the goal is for an industry to have minimal environmental impact, the most efficient and cost-effective way to achieve that is for government environmental policymakers to set standards and guidelines — for product quality and safety, and environmental and health effects — let industry figure out the best way to meet those standards, and let the market run its course.

Look at what the U.S. pulp and paper industry has done. We’ve had decades of expenditures for environmental controls with corresponding environmental benefits. We’ve recently reduced dioxin to nonmeasurable levels in virtually all mills, with significant additional capital and operating costs. Other chlorinated organics of interest have also been reduced correspondingly. We have been successful in the area of environmental control while maintaining our competitive advantage. We simply ask that the investments we’ve made not be forsaken, that costs incurred have a commensurate measurable benefit, and that our relative world competitive position be maintained.

The pulp and paper industry is among the first to agree that government has an obligation to safeguard the public and set standards for environmental performance by industry. What industry is saying, however, is that we need the flexibility to meet performance standards in the most efficient, cost-effective way. In addition, the market must be
allowed to dictate changes in product mix rather than have changes mandated for it. The pulp and paper industry is meeting the environmental challenge. The important thing now is to maintain this momentum by working in partnership with regulatory and environmental organizations to ensure that environmental expectations continue to be met in the most effective way possible.