

# ECF: The Sustainable Technology



Quality Paper  
Clean Environment





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Government organizations around the world recognize ECF's proven pollution prevention record and its contribution to sustainable ecosystem recovery. Both the U.S. EPA and the European Community have developed pulp and paper guidelines and regulations based on ECF bleaching as a core component of Best Available Technology, ensuring compliance with the International Stockholm Convention on Persistent Organic Pollutants.

ECF bleaching — based on chlorine dioxide — is the superior technology choice for sustainable pulp and paper manufacturing. Papermakers and paper users alike desire ECF's superior product quality, resource conservation attributes and compatibility with sustainable Minimum Impact Manufacturing.

Fueled by continued strong government support and proven environmental integrity, new paper mills striving for quality paper and a clean environment will use sustainable, ECF-based bleaching technology.

## A minimum impact pulp and paper mill

- minimizes the number of trees used to make a piece of paper
- maximizes energy production from biomass
- minimizes water consumption, solid waste and air emissions

### and also...

- makes high quality paper that is easily recycled
- treats and disposes of waste optimally
- creates sustainable value to society

## ECF: Core Component of Minimum Impact Manufacturing

The vision of Minimum Impact Manufacturing has captured the imaginations of industry leaders and the environmental community alike.

ECF is integral to achieving that vision of minimum impact. **ECF manufacturing produces the strongest fibers, while conserving forest resources and enhancing recyclability.**

**In combination with enhanced pulping strategies, ECF manufacturing has a higher yield, using the least amount of wood compared to other bleaching processes.** And finally, ECF is compatible with, and at the leading edge of, closed loop strategies for minimizing wastewater from bleaching. Along with efficient wastewater treatment, closed loop strategies are providing optimal solutions for protecting and sustaining the receiving water ecosystem.

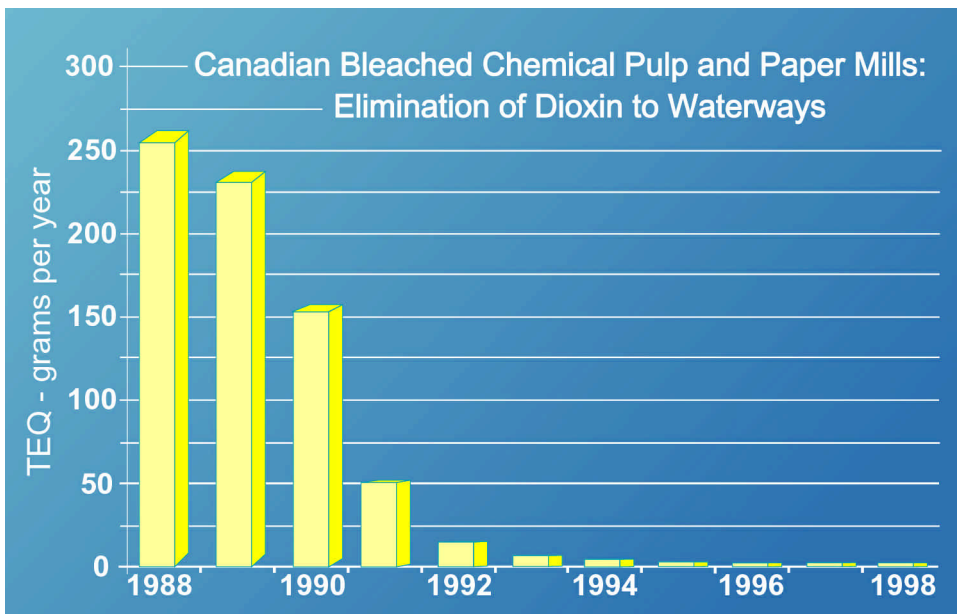


Four-stage ECF bleaching fiberline. Photo by Tom Grow, courtesy of Andritz AG.

## ECF: Proven Pollution Prevention

Experts from industry, academia, interest groups and government agree that pollution prevention means more than stopping pollutants from entering the eco-system or end-of-pipe clean-up after the fact. Pollution control and waste management fall short of true prevention: stopping pollution before it starts.

In the late 1980s, trace levels of dioxin, an inadvertent by-product of the prevailing pulp bleaching process, was discovered in the water and fish downstream of pulp and paper mills. The international pulp and paper industry quickly moved to voluntarily implement a comprehensive, multi-faceted strategy that has virtually eliminated persistent, bioaccumulative and toxic substances. **The key component of their successful pollution prevention strategy was ECF bleaching — a technology that prevents the formation of dioxin.** Worldwide experience shows papermakers have virtually eliminated dioxin discharges.



*"A notable accomplishment occurred when the pulp and paper industry changed its process for pulp bleaching by substituting chlorine dioxide for elemental chlorine. This substitution virtually eliminated the production of dioxins from pulp and paper mills"*

### International Joint Commission

*"... in Western Europe, mills stopped the use of molecular chlorine for bleaching of pulp [i.e. implemented ECF bleaching]. This means the formation of chlorinated dioxins and furans has virtually ceased..."*

### European Commission



## ECF: Compatible with a Sustainable Eco-System

*"Studies comparing ECF and TCF effluents confirmed the absence of significant differences in biological effects in the aquatic environment"*

**Institute for Papermaking,  
Darmstadt Technical  
University, Germany**



**Treated wastewater, from well-managed pulp and paper mills using ECF bleaching, is virtually free of dioxin and persistent, bioaccumulative and toxic substances.**

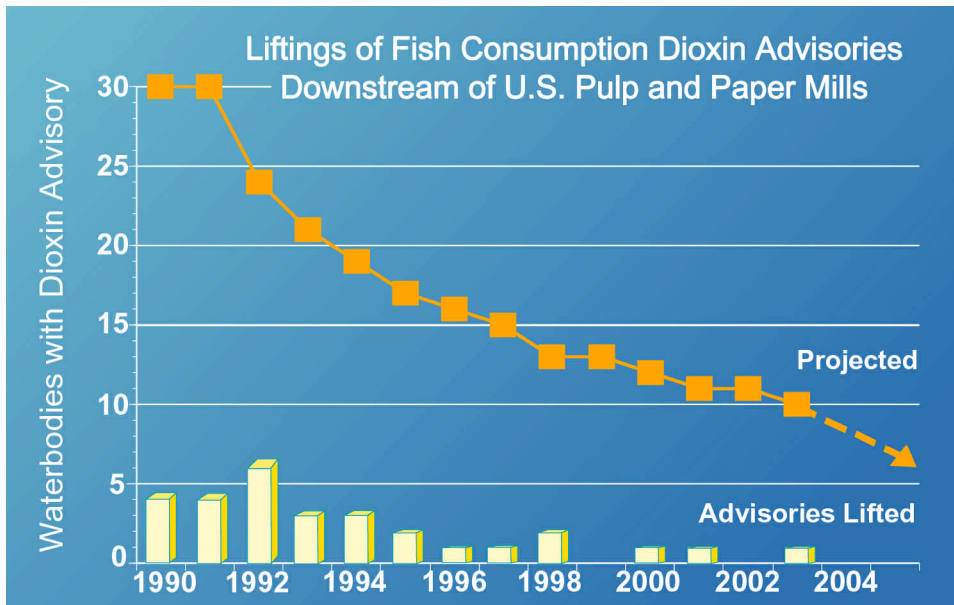
The remaining chlorine-containing organic substances resulting from ECF bleaching are similar to substances found in nature, degrade naturally and do not persist in the environment. Research shows they present a negligible environmental risk to aquatic ecosystems.

This research has been confirmed in eco-system simulations comparing wastewaters from ECF bleaching to other non-chlorine bleaching concepts, including those called Totally Chlorine-Free (TCF).

## ECF: Sustainable Eco-System Recovery

The virtual elimination of dioxin has been a key contributor to the sustainable recovery of affected aquatic eco-systems throughout the world. **Fish consumption advisories downstream of pulp and paper mills are rapidly disappearing.**

Since 1990, state authorities in the U.S. have cleared, i.e., lifted, dioxin advisories from 25 eco-systems downstream of pulp mills, representing 83 percent of the 30 such advisories in effect in 1990. In 2003, in the U.S., only 10 eco-systems remain with a dioxin advisory downstream of a bleached pulp and paper mill. The U.S. EPA predicts that over time all remaining dioxin advisories downstream of U.S. pulp and paper mills should be lifted following conversion to ECF bleaching.



*"We were especially pleased that the 'best available technology' selected for the papergrade kraft mills was an Elemental Chlorine-Free (ECF) Technology"*

**Carol Browner,  
former U.S. EPA  
Administrator**

## **ECF: The Best Available Technology**

During the 1990s, governments, responding to the environmental concerns posed by persistent, bioaccumulative and toxic compounds, developed new regulations for their respective pulp and paper industries. A common feature of many of these regulations and guidelines is the concept of Best Available Technology (BAT).

**Recognizing its superior performance, the U.S. and the European Community developed pulp and paper guidelines and regulations based on ECF bleaching as a core component of BAT.** These regulations and guidelines ensure compliance with the International Stockholm Convention on Persistent Organic Pollutants, the POPs Treaty.





## ECF: Handled with Responsible Care®



Manufacturers of sodium chlorate — the raw material for chlorine dioxide — and designers of chlorine dioxide manufacturing facilities subscribe to the codes and principles of Responsible Care®.

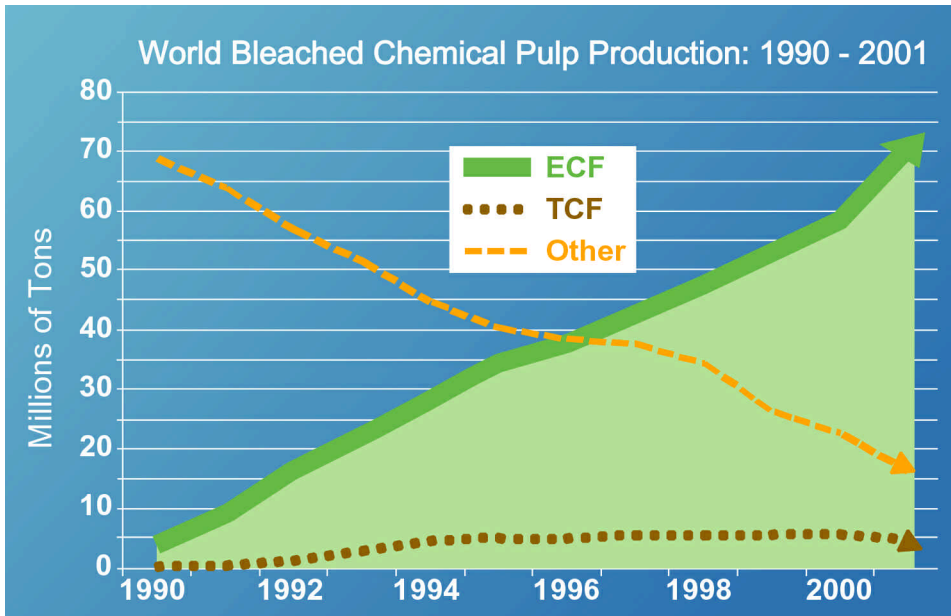
The U.S. pulp and paper industry manufactures chlorine dioxide in accordance with the U.S. Occupational Safety and Health Administration's (OSHA) Process Safety Management requirements, and protects employees and local communities through Emergency Response and Risk Management Plans.

**This commitment from suppliers, designers and manufacturers has led to over 50 years of safe industrial experience with chlorine dioxide.**

### These codes include:

- community awareness and emergency response
- pollution prevention
- process safety
- transportation and distribution
- employee health and safety
- product stewardship
- security

## ECF: Leading the Market



Demand for ECF dramatically increased over the last decade. In 2001, ECF held the highest worldwide market share for bleached chemical pulp at greater than 75 percent, or more than 70 million tons. **ECF market share continues to grow throughout the world.** This trend will be sustained as new mills planned in Germany, Chile, Brazil and Asia incorporate ECF bleaching.

*"ECF bleaching allows production of kraft pulps that meet the highest requirements with respect to strength, brightness, brightness stability and cleanliness"*

**Jan Rennel,  
Jaakko Pöyry Consulting AB,  
Stockholm, Sweden**

## Sources

Alliance for Environmental Technology. *Trends in World Bleached Chemical Pulp Production: 1990-2001*. January 2002.

Alliance for Environmental Technology. *Eco-System Recovery: Lifting of Fish Consumption Advisories for Dioxin Downstream of U.S. Pulp Mills - 2002 Update*. Washington, D.C. 2002.

Axegård P., Carey, J., Folke, J., Gleadow, P., Gullichsen, J., Pryke, D.C., Reeve, D.W., Swan, B. and Uloth, V., *Minimum-Impact Mills: Issues and Challenges*. In Environmental Impacts of Pulp and Paper Waste Streams, Stuthridge, T., van den Hueval, M.R., Marvin, N.A., Slade, A.H. and Gifford, J. (Ed). SETAC Press, 2003.

Bright, D. A., Hodson, P.V., Lehtinen, K-J., McKague, A.B., Rodgers, J.H., and Solomon, K. R. *Evaluation of Ecological Risks Associated with the Use of Chlorine Dioxide for the Bleaching of Pulp: Scientific Progress since 1993*. In Environmental Impacts of Pulp and Paper Waste Streams, Stuthridge, T., van den Hueval, M.R., Marvin, N.A., Slade, A.H. and Gifford, J. (Ed). SETAC Press, 2003.

Browner, Carol. *The Cluster Rule: A Step Forward*. Paper Age, July 1994.

Environment Canada and Federal and Provincial Task Force on Dioxins and Furans. *Dioxins and Furans and Hexachlorobenzene - Inventory of Releases*. A report prepared for the Federal-Provincial Advisory Committee for the Canadian Environmental Protection Act (CEPA-FPAC). January 1999.

European Commission. *Integrated Pollution Prevention and Control (IPPC) Reference Document on Best Available Techniques in the Pulp and Paper Industry*. July 2000.

Federal Register, Vol. 63, No. 72. April 1998.

Hamm, U. and Göttshing, L. *ECF - and TCF Bleached Pulps: A Comparison of their Environmental Impact*. German Pulp and Paper Association VDP – INFOR project (No. 19), 2002.

International Joint Commission (IJC). *10th Biennial Report on Great Lakes Water Quality*. July 2000.

1996 NCASI Dioxin Profile. *Progress in Reducing the TCDD/TCDF Content of Effluents, Pulps, and Wastewater Treatment Sludges from the Manufacturing of Bleached Chemical Pulp*. Special Report 97-04. May 1997.

Rennel, J., *TCF — An Example of the Growing Importance of Environmental Perceptions in the Choice of Fibres*. Nordic Pulp and Paper Research Journal. No. 1. 1995.

Stratton, S. C. and Gleadow, P. *Pulp Mill Process Closure: A Review of Global Technology Developments and Mill Experiences in the 1990s*. NCASI Technical Bulletin No. 860. May 2003.

Stockholm Convention on Persistent Organic Pollutants. Stockholm, Sweden. May 2001.

Tana, J. and Lehtinen, K-J., *The Aquatic Environmental Impact of Pulping and Bleaching Operations - An Overview*. Finnish Environmental Agency, Helsinki. 1996.

The U.S. Environmental Protection Agency. May 2002. *Update: National Listing of Fish and Wildlife Consumption Advisories, Fact Sheet*. U.S. Environmental Protection Agency, Office of Water. EPA-823-F-02-007.

The U.S. Environmental Protection Agency. November 1993. *Regulatory Impact of Proposed Effluent Guidelines and NESHAP for the Pulp, Paper, and Paperboard Industry*. U.S. Environmental Protection Agency, Office of Water Regulations and Standards.

The U.S. Environmental Protection Agency. 2000 *TRI Emissions Report*.



Alliance for Environmental Technology

6061 10th Line • RR #1 • Erin, Ontario • NOB 1T0 • T: 519.855.4979 • F: 519.855.4313

1250 24th Street NW • Suite 300 • Washington, DC • 20037 • T: 1.800.999.PULP

[info@aet.org](mailto:info@aet.org) • [www.aet.org](http://www.aet.org)

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