

## FACT SHEET No. 29

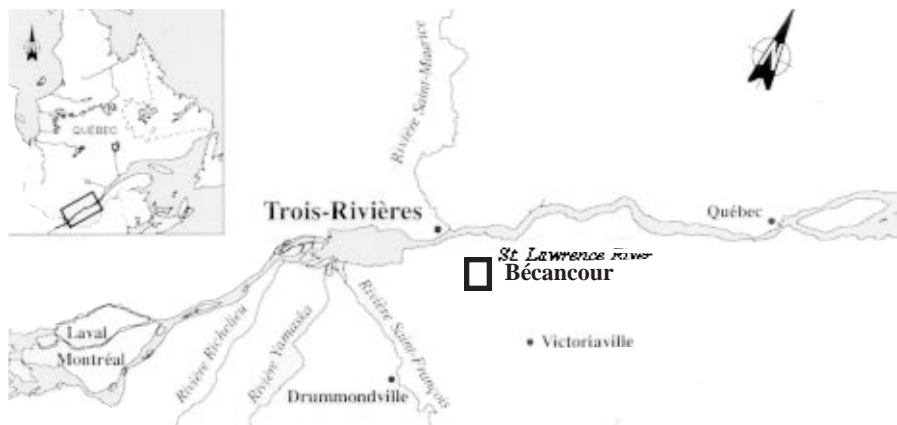
# ICI Canada Forest Products

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*A list of 106 industrial plants has been established under St. Lawrence Vision 2000 (SLV 2000), the second phase of the St. Lawrence Action Plan, launched in 1988. The overall objective is to reduce liquid toxic waste and virtually eliminate discharges of persistent toxic substances.*

*The 106 industrial plants designated under SLV 2000 are divided into four groups, each of which has been given a specific objective. The ICI CANADA FOREST PRODUCTS plant, located in Bécancour, is part of Group 4, comprising the 50 plants targeted under the St. Lawrence Action Plan.*

*The objective set for Group 4 is to pursue cleanup efforts and perform environmental monitoring to achieve a 90% reduction in liquid toxic waste. Between 1988 and 1995, the 50 plants reduced their toxic effluent discharges by 96%.*



## INDUSTRIAL PLANT

### Diaphragm cells

The ICI CANADA plant in Bécancour manufactures chlorine, caustic soda, hydrochloric acid, hydrogen and sodium hypochlorite from electrolytic diaphragm cells. A layer of porous asbestos separates the anode from the cathode, which explains the name "diaphragm cells". The process involves electrolysis of a brine. During the process, chlorine is given off by the anode, and hydrogen and hydroxide ions are formed at the cathode. The chlorine gas is cooled, dried and compressed. It is then liquefied and stored in tanks. A large quantity of the hydrogen obtained during the process is sold; the remaining hydrogen is used in the production of hydrochloric acid or as fuel. The hydrochloric acid is obtained by the combustion of hydrogen and chlorine. The HCl gas is then absorbed in water to form a solution. Caustic soda is obtained when the liquor is concentrated by evaporation. The final product is cooled and filtered prior to being stored. The plant has a nominal production capacity of 300 000 t/yr of caustic soda, 270 000 t/yr of chlorine, 100 000 t/yr of hydrochloric acid, 7000 t/yr of hydrogen, and a variable quantity of sodium hypochlorite. In 1995, the plant operated at full rated capacity for both chlorine and caustic soda, and employed a work force of 220. The capacity utilization rate for the other finished products depends on market demand.

## PRODUCTION

### PRINCIPAL RAW MATERIALS

- Salt (sodium chloride)
- Water
- Electricity

### FINISHED PRODUCTS

- Chlorine
- Caustic soda
- Hydrochloric acid
- Hydrogen
- Sodium hypochlorite

# TREATMENT MEASURES

## INITIAL EFFLUENT VALUES

### *Effluent containing dissolved solids and chlorides*

In 1988, company data showed that the effluent averaged 4960 m<sup>3</sup>/d, containing:

- 5463 kg/d of dissolved solids
- 3256 kg/d of chlorides
- 12 kg/d of suspended solids (ss)
- 3.8 kg/d of chlorine
- 2.4 kg/d of chromium

## RESOURCES AND USES TO PRESERVE

### *Hunting and fishing*

The main effluent of the ICI CANADA FOREST PRODUCTS plant is discharged into the St. Lawrence. The Gentilly foreshore flats attract a wide range of animal species in the Bécancour region (spawning grounds for Yellow perch, Brown bullhead, Common carp, Burbot and Lake whitefish). There is also a spawning ground for the Northern pike downstream from the Bécancour wharf in the Gentilly marsh, whose great size makes it one of the four most favourable zones for waterfowl between Lake Saint-Pierre and Quebec City. Several species of ducks and geese live there when nesting or during their migration. Fishermen and hunters stimulate the local economy through sport and commercial fishing, muskrat trapping, and duck hunting. There is a water intake near Bécancour that supplies the industrial zone. The Gentilly nuclear station has its own private intake in Gentilly.

## WATER QUALITY BASED OBJECTIVES

### *Environmental protection*

Water quality based objectives are established to preserve local resources and uses. These guidelines, expressed as maximum permissible loads and concentrations for effluent released into the environment, are used in choosing treatment methods which best promote environmental protection. ICI CANADA FOREST PRODUCTS' water quality based objectives are available on request.

## EFFLUENT TREATMENT

### *Primary treatment*

Industrial wastewater that may contain chlorine is treated chemically with sodium metabisulphite in a submerged tank, and is then neutralized. Neutralization and adjustment of the pH level of the effluent is done in two reactors connected in series. Effluent from the chlor-alkali units is sent to an effluent basin, and part of the discharge returns to the manufacturing process. Rainwater and run-off are collected in the sumps of the chlor-alkali units. The pH level of the effluent is checked in a tank before it is pumped to the river. The residual water that needs its pH level adjusted is sent to an effluent neutralization system. The Bécancour Industrial Park and Port Association treats domestic wastewater. The total discharge of effluent varies, according to the time of year, from 3000 m<sup>3</sup>/d to 9000 m<sup>3</sup>/d. The main reason for the change is a greater use of indirect cooling water during the summer.

## PREVENTION AND CLEANUP SYSTEMS IMPLEMENTED

### *A computerized effluent control system*

From 1985 to 1992, the ICI CANADA FOREST PRODUCTS plant implemented cleanup measures in order to substantially reduce the quantity of dissolved solids, chlorine and chromium in the effluent (program of treatment measures in 1985). In 1992, the Bécancour plant acquired a computerized data collection system to obtain pertinent information about the rapidly effluent. Thanks to this system, there were fewer violations of the standards and fewer spills. The same year, the step involving chemical chlorine destruction was also computerized in order to attain "zero discharge" for this pollutant. When the chromium-zinc treatment used in the cooling towers was discontinued in 1993, chromium and zinc were completely eliminated from the effluent. In 1994, a cleanup project was introduced to recycle part of the wastewater for salt dissolution.

## REGULATORY COMPLIANCE - WATER COMPONENT

### *Compliance with certificate of authorization standards*

The ICI CANADA FOREST PRODUCTS plant must meet the standards of a certificate of authorization (CA) issued by the Ministère de l'Environnement du Québec (MENVIQ) in 1978. In general, there is compliance with the standards.

# POLLUTION ABATEMENT

## CHIMIOTOX INDEX ABATEMENT OF TOXIC POLLUTION

The Chimiotox index gauges the load of all the toxic substances in industrial effluent, using the toxicity factor assigned to each one. It is used, among other things, to monitor discharge trends over the years (see Figure 1) and determine the proportion of each pollutant (see Table 1).

Table 1 gives the characterization data gathered in 1990 pursuant to Action Plan requirements, as well as the Chimiotox values calculated from them for an effluent discharge of 5403 m<sup>3</sup>/d. Eighteen substances were detected in testing for more than 120. From the data it can be seen that there was a preponderance of chromium in the treated water. Chromium represented 35% of the Chimiotox index, followed by chlorine with 30%, then arsenic and mercury with 20% and 10%, respectively.

Figure 1 is plotted from the Action Plan characterization data for 1990. The Chimiotox indices for 1988 to 1995 are based on the figures from the 1990 Action Plan characterization, which were adjusted using monthly data from the company for chromium, total chlorine and zinc.

Between 1988 and 1992, the 40% decrease in the Chimiotox index can be attributed to the completion of a program of treatment measures started in 1985. In 1993, discontinuation of the chromium-zinc based treatment in the cooling towers, improvement of the chlorine destruction process, and introduction of a data acquisition system, made it possible to decrease the Chimiotox index an additional 34% over the 1992 results. From 1988 to 1995, the Chimiotox index fell by 60% thanks to the newly introduced cleanup measures.

Table 1 Chimiotox Index (1990) - ICI Canada Forest Products\*

Substance	Load (kg/d)	Toxic Weighting Factor	Chimiotox Units (CU)
Chromium	3.600	500	1 800
Total Chlorine	3.200	500	1 600
Arsenic	0.018	57 143	1 029
Mercury	0.003	166 667	533
Copper	0.134	424	57
Lead	0.104	314	33
Zinc	2.153	9	20
Iron	2.835	3	9
Total Phenols	0.042	200	8
Total Phosphorus	0.148	50	7
Nickel	0.242	10	2
Nitrites-Nitrates	0.391	5	2
Chloroform	0.029	64	2
Manganese	0.137	10	1
Cyanides	0.007	200	1
CarbonTetrachloride	0.007	144	1
Trichloroethylene	0.017	12	<1
Ammonia Nitrogen	0.230	0.8	<1

### CHIMIOTOX INDEX

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\* For effluent discharge of 5403 m<sup>3</sup>/d (18 substances detected in testing for more than 120).

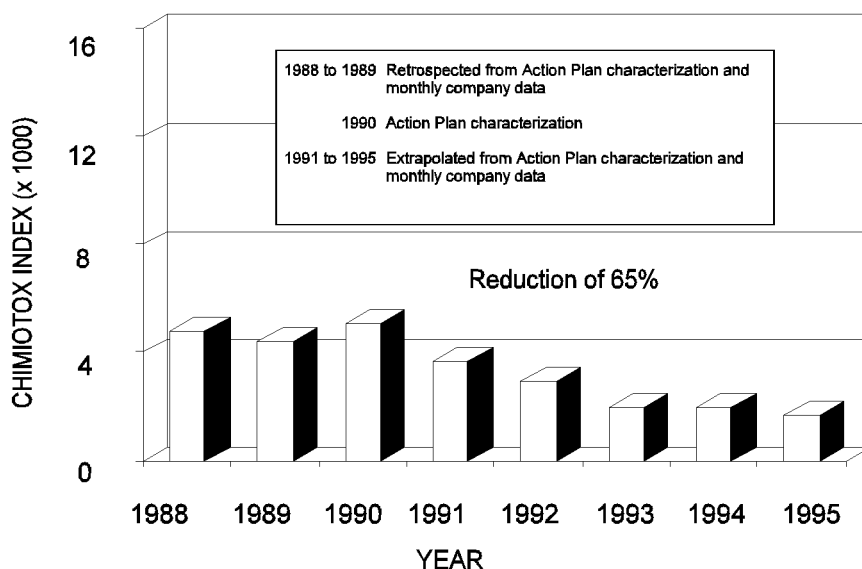


Figure 1 Changes in toxic effluent discharges, 1988-1995 - ICI Canada Forest Products

## VIRTUAL ELIMINATION OF PERSISTENT TOXIC SUBSTANCES

One long-range objective of SLV 2000 is the virtual elimination of 11 persistent bioaccumulative toxic substances from the effluent produced by the 106 priority plants along the St. Lawrence and its tributaries. The targeted substances are those designated by the International Joint Commission in August 1993: PCBs, DDT, dieldrin, toxaphene, dioxins, furans, Mirex, mercury, lead alkyl, benzo(a)pyrene and hexachlorobenzene.

At the time the characterization study was carried out for Action Plan in 1990, mercury was detected. The mercury load was 0.003 kg/d. During the period targeted by SLV2000 (1993-1998), the plant is required, at the very least, to attain the relative environmental discharge standards so as to protect a uses of the receiving environment. In the case of ICI CANADA FOREST PRODUCTS the water quality based mercury discharge objectives were set at  $6 \times 10^{-6}$  mg/L or  $3.03 \times 10^{-5}$  kg/d.

## PEEP TOXICITY REDUCTION

### *Low-toxicity effluent*

The Potential Ecotoxic Effects Probe, or PEEP, combines the results from six standardized bioassays measuring the toxic effects of effluent. The results are expressed on a logarithmic scale of increasing toxicity ranging from 1 to 10 and are used to monitor discharge trends over the years. In the case of the ICI CANADA FOREST PRODUCTS plant in Bécancour, one series of bioassays was conducted. In 1990, the PEEP value was 3.2. This was one of the lowest of the PEEP values found for the 50 Action Plan plants.

## REDUCTION IN SUBSTANCES MONITORED

### *Elimination of chromium, chlorine and zinc discharge*

In 1995, company data showed the plant had an average effluent discharge of 4322 m<sup>3</sup>/d, containing;

- 3846 kg/d of dissolved solids
- 3515 kg/d of chlorides
- 337 kg/d of sulphates
- 26.1 kg/d of suspended solids (ss)

Company data for 1988 to 1995 show that chromium, chlorine and zinc were completely eliminated from the effluent. This is due to the cleanup measures that were introduced and the discontinuation of the chromium-zinc-based treatment in the cooling towers.

## KEY POINTS

- Since 1987, introduction of several cleanup procedures to reduce the load of the main pollutants; elimination of chlorine in the effluent
- Discontinuation of the chromium-zinc based treatment in the cooling towers; elimination of chromium and zinc in the effluent
- 65% reduction in the Chimiotox index

Based on December 1995 inventory.  
Information reviewed by Gilles Legault, SLV 2000.

## ADDITIONAL INFORMATION

**Chimiotox index and PEEP:** Gilles Legault,  
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Published by authority of the Minister of the Environment

© Minister of Supply and Services Canada 1996  
Catalogue No. En153-6/29-1996E  
ISBN 0-662-23380-8

(Aussi disponible en français sous le titre *Établissements  
industriels - faits saillants*).