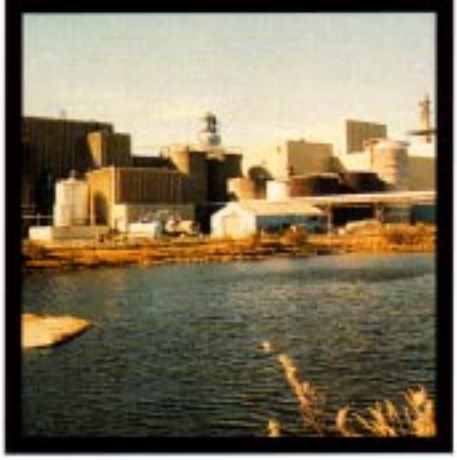
St. Lawrence TECHNOLOGIES

INDUSTRIAL WASTEWATER

APPLICATION OF THE ZERO EFFLUENT CONCEPT TO THE UNIFORÊT PULP MILL IN PORT-CARTIER



ABSTRACT

The Uniforêt pulp mill in Port-Cartier operates a chemical-thermo-mechanical pulp bleaching plant integrated with a nearby sawmill. Uniforêt will achieve energy self-sufficiency from recycling sawmill residues along with pulp mill residues in a heat-recovery bark boiler. To meet the desired objectives, an extensive process water segregation and reduction program was implemented, multiple-effect evaporators were modified to achieve the desired concentrating ratios, ancillary equipment was installed, and a modified bark boiler was upgraded to accept a mixture of biomass and process residues. Finally, a wet scrubber was installed to treat the boiler's gaseous emissions.

MAIN FEATURES

- **Technology**
  - Wastewater flow reduction from 60 m³/t to 15 m³/t.
  - Multiple-effect evaporators concentrate waste streams.
  - Fiber recovery.
  - Equalization tank installation.
  - White water recycling to pulping machine showers.
  - Heat recovery from uncontaminated cooling water before discharge off-shore.
  - Energy self-sufficiency through combustion of pulp mill concentrates and sawmill residues.
- **Environment**
  - Significant reduction in water consumption.
  - Reduction in energy needs.

Saint-Laurent Vision 2000

Environment Canada Québec Region

Environnement Canada Région du Québec

ZEROTECH ZERO EFFLUENT TECHNOLOGY

NLK Consultants Inc.

Uniforêt

PROJECT OBJECTIVES

To demonstrate the technical and economic viability of the zero-effluent discharge concept developed by the firm Zerotech Technologies Inc. at the Uniforêt Inc. chemical-thermomechanical pulp bleaching mill in Port-Cartier. The mill has a capacity of 500 mt per day.

PHASES

I Addition of a 300 000 000 PMP sawmill to the debarking operations and servicing of a turbogenerator.

II Segregation of uncontaminated cooling water. Reduction in wastewater generated by several mill departments. Effluent evaporation using multiple-effect evaporators.

III Steam generation from joint combustion of wastewater concentrates and sawmill residues.

BACKGROUND

Uniforêt Inc. purchased the pulp and paper mill in Port-Cartier under difficult economic conditions. Indeed, Uniforêt Inc. acquired the mill after its two previous owners, ITT Rayonier (chemical pulp) and Cascades (TMCBP), abandoned operations due to non competitive production. However, Zerotech Technologies Inc. convinced Uniforêt to reuse some of the on-site equipment in order to convert the mill to a closed loop system. With this process, the mill would have zero discharge while conforming to regulations. The challenge facing both companies was to pair multiple-effect evaporation with combined combustion of process concentrate and sawmill residues in a modified bark boiler to produce the steam necessary for the pulp mill's daily production capacity (500 mt / day).

TECHNOLOGY

Characterization details of the wastewater directed to evaporators are shown in Table 1. Table 2 presents the estimated composition of the resulting evaporator concentrate. Estimated composition of the ashes of the evaporator concentrate are shown in Table 3.

1 - **Wastewater flow reduction from 60 m³/t to 15 m³/t.**
- Segregation of cooling and process waters.
- Installation of fiber-screening systems at critical points in the process.
- Recycling of screened fibers and reuse of clarified water.
- Redirection of all process waters to the evaporators.

2 - **Surge basins**

Wastewater equalization to compensate for process upsets.

3 - **Pulping machine showers**

Water supplied to modified machine showers allows water recycling following screening and filtration.

4 - **Cooling water**

Installation of tube or plate heat-exchangers to cool process equipment without contacting contaminated effluents.

TABLE 1

COMPARAISON OF CHARACTERISTICS OF PROCESS WATER DIRECTED TO THE MULTIPLE-EFFECT EVAPORATORS AND COOLING WATER

Parameters	Process water before treatment*	Fresh water used for cooling**
Flow rate, m³/d	7 500	45 000
COD, kg/d	80 000	------
BOD_5, kg/d	25 000	------
Suspended solids, kg/d	19 000	------
pH	6,0 - 8,5	5,2 - 5,8
Temperature, °C	67	1 - 15
Toxicity (96 h), % LC_{50}	1	> 100

* Effluents include hot and cool streams.

** Cooling water pumped from Rivière aux Rochers.

RESULTS

Environment

Implementation of the Zerotech process at Uniforêt's Port-Cartier pulp mill reduced water consumption by nearly 75%. Cooling waters from the mill are combined prior to being channelled to a sampling point and then to a diffuser for discharge at sea. Both contaminated and uncontaminated distillates, and make-up water are discharged to an aerated lagoon for treatment. Lagoon effluents are polished by filtration prior to being returned to the mill as process water. Pulp mill and sawmill residues are jointly combusted to recover heat energy, and resolve the problem of sludge disposal.

Costs

The economic success of the process is due in large part to the simultaneous start-up of the sawmill and the pulp mill, making the Zerotech process economical compared with conventional treatment technologies. Where such conventional processes cannot meet regulatory requirements, the Zerotech technology may be the only option available for the maintenance of pulp mill operation.

TABLE 2

ESTIMATED COMPOSITION OF EVAPORATOR CONCENTRATE

Compound	Masse basis, (%)*
Carbon	27,2
Hydrogen	3,0
Oxygen	39,8
Sulphur	4,0
Sodium	20,0
Potassium	0,6
Calcium	0,6
Magnesium	0,6
Silica	3,0
Chlorine	0,7
Aluminium	0,4
Trace elements	0,1
Total	**100,0**

*** Calculated on a dry basis.**

TABLE 3

ESTIMATED ASH COMPOSITION FROM THE COMBUSTION OF MULTIPLE-EFFECT EVAPORATOR CONCENTRATE

Compound	Mass Basis, %*
Carbonates	37,2
Sulfates	19,7
Sodium	33,1
Potassium	1,0
Calcium	1,0
Magnesium	1,0
Oxides of silica	5,0
Chlorine	1,2
Aluminium	0,7
Trace elements	0,1
Total	**100,0**

*** Calculated on a dry basis.**

POTENTIAL AND LIMITATIONS

Successful implementation of the Zerotech process at the Uniforêt pulp mill is due mainly to the following:

1 - The saw mill proximity to the pulp mill made the fuel required to evaporate the liquid wastes from mill operations easy to obtain.

2 - The reconditioning and start-up of the multiple-effect evaporators and other equipment already on-site.

3 - The acquisition of the site and pulp mill at an attractive price.

INFORMATION

This fact sheet is based on the results of a technological demonstration and development project carried out by Uniforêt Inc. of Port-Cartier with the technical and financial collaboration of Environment Canada.

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