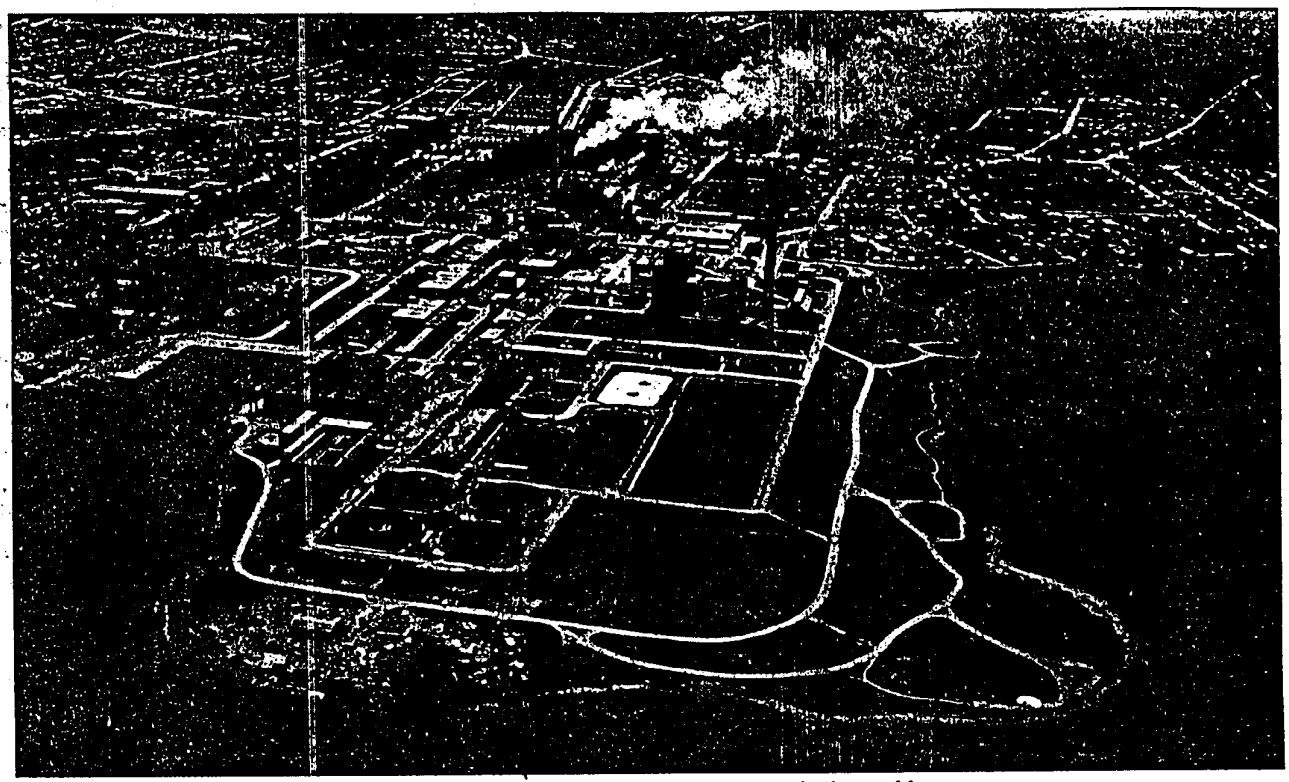


Riocell SA's mill in Brazil has one of the most complete effluent treatment systems in the world.

ISSUE FOCUS: AIR/WATER QUALITY

ADVANCED WASTE TREATMENT SYSTEM REMOVES COLOR, SUSPENDED SOLIDS

Brazilian paper and market pulp mill installs high-efficiency waste treatment plant before starting bleaching operation

By CELSO FOELKEL

Riocell SA (formerly Industria Celulose Borregaard) is a 16-year-old pulp and paper company in Rio Grande do Sul, a city in southern Brazil. The mill was originally designed to produce 793 air-dry (a.d.) tpd of unbleached kraft pulp or 1,080 a.d. tpd of dissolving grade pulp.

The raw wood material used at the Riocell mill is 75% eucalyptus and 25% acacia. Formerly, the unbleached pulp was shipped to Norway for bleaching and subsequent marketing in European countries. The mill's eucalyptus pulp was among the first introduced into specialized, sophisticated markets that demanded high quality.

When the ownership changed and the link with Norway weakened, management pushed to complete the mill. Now, Klabin, Iochpe, Votorantin (KIV) is the major owner, and BNDESPAR, a state bank, maintains an important share.

Currently, 716 a.d. tpd of bleached market pulp, 132 tpd of printing and writing paper, 176 a.d. tpd of unbleached market pulp, and 77 a.d. tpd of a semichemical filler pulp are produced. During dissolving grade runs, total production drops to 716 a.d. tpd, which is largely due to the intrinsic characteristics of the prehydrolysis kraft process.

Mr. Foelkel is quality and R&D manager, Riocell SA, Brazil.

ENVIRONMENTAL TROUBLES. The mill is located near Pôrto Alegre, a city of 1.2 million inhabitants on the right bank of the Guaiba River (a kind of ecological heritage of the so-called "gaucho" people living in the state).

The mill had problems with environmental authorities and the population before the bleaching project took place, and the company image was seriously damaged at that time. Thus, special attention was paid to environmental concerns and the production process, and today the mill is a well-known example of pollution control efforts.

Jaakko Pöyry Oy, which has provided engineering for the mill since its inception, handled engineering and construction management for the recent environmental projects and the new bleach plant. The environmental concept behind the mill is to keep final residues to a minimum and recover losses in the mill areas where they are generated.

To do this, a losses recovery system was installed in 1980. When the bleaching plant started up in 1983, the new wastewater treatment plant, which had begun operating in 1982, was ready to receive effluents. Effluents were treated at a tertiary level using the best available technology and then discharged, "free of pollution," into the Guaiba River.

TABLE 1: **Efficiency of waste treatment system at Riocell SA mill in Brazil.**

Overall efficiency	
BOD_5	98% to 99%
COD removal	91%
Suspended solids removal	97%
Color removal	90%
Treated effluent characteristics	
Specific organic load	
kg BOD_5/a.d. ton	0.2 to 0.3
kg COD/a.d. ton	5.0 to 5.5
Suspended solids specific load	
kg SS/a.d. ton	0.4 to 0.5
Color specific load	
kg PtCo/a.d. ton	19 to 20

TREATMENT SYSTEM. The effluent treatment system is illustrated in Figure 1. Effluents from various areas, except the bleaching plant, are collected in underground pipelines and conveyed to the treatment plant by gravity.

The general effluent initially passes through a grit chamber and a screening system, going finally to a neutralization tank, which also receives the bleaching effluents. Neutralized effluent is fed to settling units for suspended solids removal. It is then cooled to 37° or 38°C in heat exchangers.

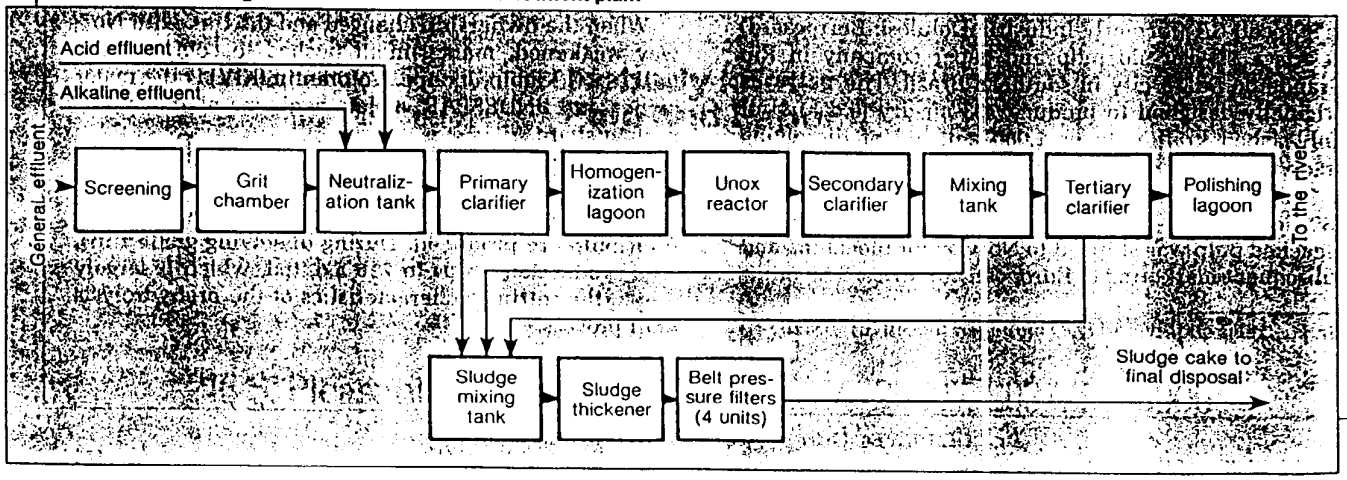
In the case that abnormal conditions occur, effluent is sent to an emergency lagoon and gradually put back into the system later. Effluent is then homogenized in a lagoon with surface aerators and finally pumped to the Unox reactor and secondary clarifiers. The Unox system is an activated sludge system that is largely based on the use of oxygen to promote the effective growth and action of microorganisms.

The biologically treated effluent is then sent for color removal, which is achieved by flocculation with aluminum sulphate addition, followed by sedimentation. Finally, effluent is neutralized with lime, put into a polishing lagoon, and discharged into the river through diffusers. Primary, secondary, and tertiary sludge is thickened and dewatered in belt pressure filters. The treatment system's overall efficiency is demonstrated in Table 1.

MILL INVESTMENT. Since the mill's early days, the company has invested $45 million in environmental protection systems, 60% of which has gone toward wastewater treatment facilities. The effluent plant required a capital expenditure of $20 million, and the operational cost is $200/1,000 m³. The average flow is 35,000 m³/day.

An important research program aimed at converting sludge and other mill residues (grit, dregs, flyash, etc.) into organic fertilizer has already been started. The fertilizer generated by this process will supply part of the chemical nutrients to the 98,800 acres of forest owned by the company. ■

FIGURE 1: **Flow diagram of Riocell SA effluent treatment plant**



Advanced Waste Treatment System Removes Color, Suspended Solids

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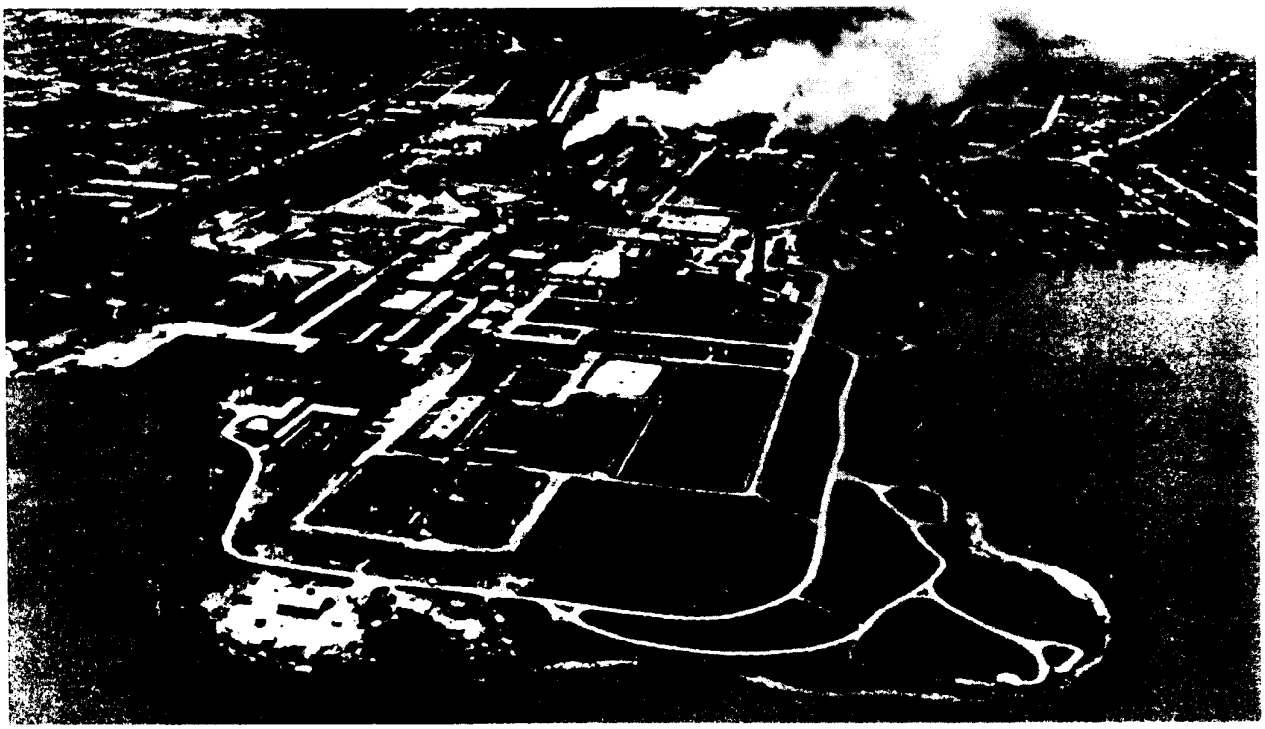

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Suspended solids removal	97%
Color removal	90%
AOX	85%
Treated effluent characteristics	
Specific organic load	
kg BOD_5/a.d. ton — 0.2 to 0.3	
kg COD/a.d. ton — 5.0 to 5.5	
Suspended solids specific load	
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Color specific load	
kg PtCo/a.d. ton — 19 to 20	
AOX	
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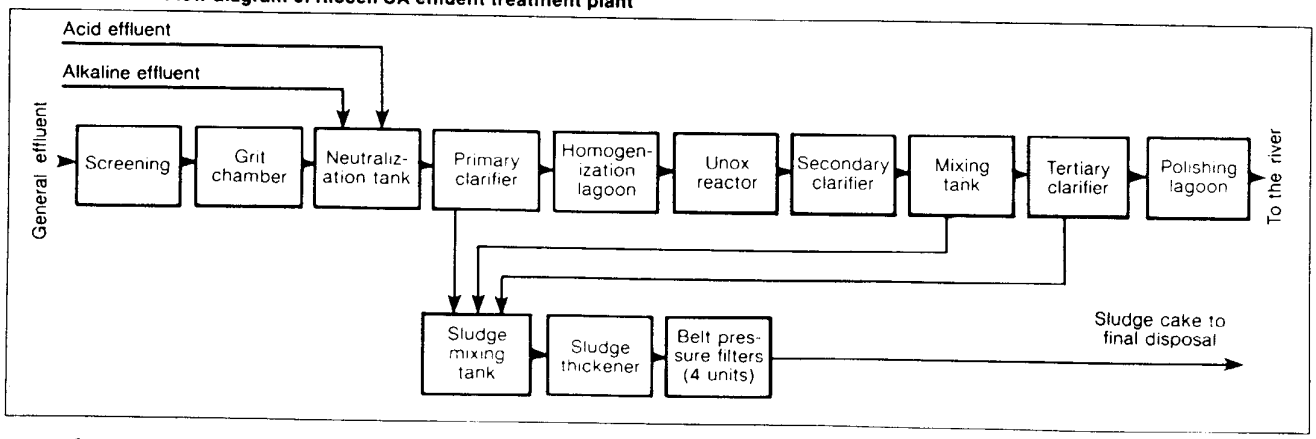

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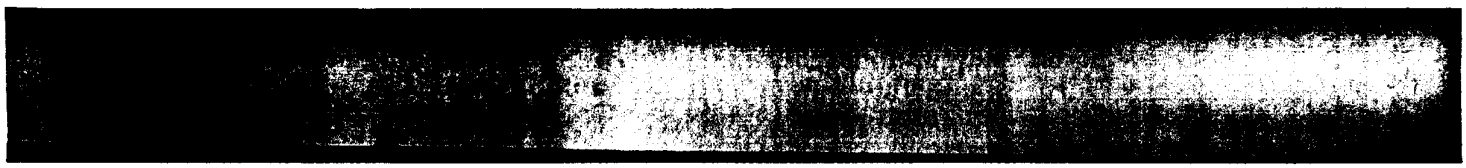

SECTION 3. **Air Emission Control**

SECTION 4. **Solid Waste Handling and Minimization**

ENVIRONMENTAL SOFTWARE

For the Pulp and Paper Industry

Edited by Kelly Ferguson