

Environmentally Sound Technologies & Clean Technologies

Best Available Technologies to the Pulp & Paper Industrial Segment
Bleached Kraft Process

Celso Foelkel

| Best Available Process Technologies |
|--|
| |
| WOOD HANDLING / BIOMASS FUEL |
| <ul style="list-style-type: none">• Dry debarking of logs |
| <ul style="list-style-type: none">• Biomass fuel to save NRF (No Renewable Fuels) |
| <ul style="list-style-type: none">• Composting or other utilization of the wasted biomass from wood yard |
| <ul style="list-style-type: none">• Low energy conveyors |
| <ul style="list-style-type: none">• Bark dryers or presses to improve fuel quality |
| |
| PULPING |
| <ul style="list-style-type: none">• Cooking modifications to reduce bleaching chemicals (extended cooking, higher yield, compact cooking, low-solids, super-batch) |
| <ul style="list-style-type: none">• Additive utilization to speed up delignification (surfactant, anthraquinone, etc) |
| <ul style="list-style-type: none">• Oxygen delignification |
| <ul style="list-style-type: none">• ECF (Elemental Chlorine Free) or TCF (Total Chlorine Free) bleaching |
| <ul style="list-style-type: none">• Highly efficient closed cycle brown stock washing |
| <ul style="list-style-type: none">• Washing presses to better remove carry-over of chemicals |
| |
| |
| BLEACHING |
| <ul style="list-style-type: none">• Enzyme bleaching |
| <ul style="list-style-type: none">• Acid stage - pre bleaching |

| |
|--|
| <ul style="list-style-type: none"> • Highly efficient washing presses |
| <ul style="list-style-type: none"> • Bleaching with low AOX generation |
| <ul style="list-style-type: none"> • Partial recovery of bleaching stages filtrates |
| <ul style="list-style-type: none"> • Filters to recover fibers and solids from bleaching effluents |
| <p style="text-align: center;">RECOVERY OF LIQUOR; ENERGY plus STEAM CONSUMPTION</p> |
| <ul style="list-style-type: none"> • Low odor or odor less recovery boiler technology |
| <ul style="list-style-type: none"> • Extra capacity in the recovery boiler and evaporation plant to cope with extra demands such spills |
| <ul style="list-style-type: none"> • Totally indirect heating evaporators, with no direct contact |
| <ul style="list-style-type: none"> • Reuse of important part of evaporation condensates |
| <ul style="list-style-type: none"> • Collecting and burning odor gases in lime kiln, captive incinerator or boilers |
| <ul style="list-style-type: none"> • Burning or absorbing vent gases in captive burner or scrubber |
| <ul style="list-style-type: none"> • Black liquor oxidation |
| <ul style="list-style-type: none"> • Methanol recovery |
| <ul style="list-style-type: none"> • Efficient multiple effect evaporators |
| <ul style="list-style-type: none"> • Fluidized bed boilers |
| <ul style="list-style-type: none"> • Flash dryers to lime kiln |
| <ul style="list-style-type: none"> • Tall oil and turpentine recovery |
| <ul style="list-style-type: none"> • Condensate stripping and gas management |
| <ul style="list-style-type: none"> • Process conditions for minimum SO₂ generation or emissions from boilers and lime kiln |
| <ul style="list-style-type: none"> • NO_x reduction by optimum design and operation of combustion |
| <ul style="list-style-type: none"> • High performance electrostatic precipitators |
| <ul style="list-style-type: none"> • Total electricity consumption (less than 0.7 MWh per air dry ton of pulp) |
| <ul style="list-style-type: none"> • Total steam consumption (less than 7 ton steam per air dry ton of pulp) |

| |
|---|
| |
| PULP SHEET MANUFACTURING |
| <ul style="list-style-type: none"> • Closure of water systems • Recovery of fibers |
| |
| CHEMICAL PLANT |
| <ul style="list-style-type: none"> • Closed cycle chemical manufacturing • Membrane cells to caustic soda making • Elemental chlorine free manufacturing of chlorine dioxide |
| |
| EFFLUENT TREATMENT |
| <ul style="list-style-type: none"> • Effluent treatment plant. Secondary activated sludge • Effluent treatment plant • Tertiary flocculation / flotation / clarification • Ultra-filtration and reverse osmosis |
| |
| SOLID WASTE TREATMENT |
| <ul style="list-style-type: none"> • Sludge presses • Anaerobic digestion • Recycling of solid wastes • Composting of solid wastes • Hazard wastes management • Landfill design and operation |
| |
| GENERAL ECO-EFFICIENCY TECHNIQUES |
| <ul style="list-style-type: none"> • Automation and process control for environmental parameters • Spills recovery system • Water system closure • Gas collection from tank vents, scrubbing and/or incineration • Environmental monitoring outside the fences |

