

New Scrubbers Help Boise Cascade Exceed Clean Air Regulations

Facing stiffer environmental regulations in a competitive marketplace, much of the success of today's paper mill rests in maintaining efficiency of its operations. For Boise Cascade Corporation, a multiple scrubber system is helping to maintain high efficiency of its bleach plant in Rumford, Maine.

The engineering design firm Caldwell-MacKay Company, Inc., Birmingham, Alabama, specified the design of the scrubber system, which combines four identical scrubbers -- a series of two in a line -- each measuring 8' by 56'-6".

According to Rick MacKay, vice president of engineering, Caldwell-MacKay, air emissions of pulp and paper mills must comply with the Clean Air mandate *MACT -- Maximum Achievable Control Technology*. In addition, the state of Maine enacts the toughest standards for air quality control of pulp and paper plant emissions in the U.S., allowing a maximum emission of only three pounds per hour each of chlorine and chlorine dioxide per paper mill.

"The maximum technology we could offer Boise Cascade was the four-tower scrubber system, for which total emissions are well below one pound per hour," notes MacKay. "The system far exceeds EPA and OSHA emissions limits."

Jim Stewart, project coordinator, Boise Cascade, explains that both lines feature a chlorine scrubber and a chlorine dioxide scrubber in series. "One line is used for our hardwood bleach plant process, and the other is used for our softwood bleach plant.

"The chlorine scrubber for each line utilizes either caustic or weak white liquor," Stewart continues.

"The caustic solution consists of 30 percent sodium hydroxide, while the weak white liquor consists of 25 grams per liter of titratable alkaline (TTA). The chlorine dioxide scrubber for each line uses either weak white liquor or white liquor consisting of 120 grams per liter of TTA."

"The first tower removes about 95 percent of the chlorine gas and approximately 40 percent of the chlorine dioxide gas," adds MacKay. "The second tower removes the remaining chlorine dioxide and trace chlorine. The end result is a minimal emission of less than one pound per hour of chlorine and chlorine dioxide."

The scrubbers were designed to handle 800 - 1,100 gallons per minute of liquids and 17,000 cubic feet per minute of gases. Normal operating temperatures range from 120°-140°F, with a maximum design temperature of 170°F.

The scrubbers feature a one-piece dual laminate construction consisting of a 3/16"-thick polyvinyl chloride (PVC) inner lining laminated with an outer structure of 5/8"-thick FRP. The FRP secondary corrosion barrier was fabricated using a 1/8"-thick hand laid-up inner laminate made of DERAKANE 411-45 epoxy vinyl ester resin, followed by a 1/2"-thick filament-wound outer structural laminate made of DERAKANE 510C-350 epoxy vinyl ester resin, cured with methyl ethyl ketone peroxide-cobalt naphthenate.

"DERAKANE 411-45 resin was specified for its workability and corrosion-resistant properties, while DERAKANE 510C-350 was specified for its added corrosion resistance as well as ignition-

inhibiting properties¹," says MacKay. Nyacol APE-1540 also was used in fabricating the outer structural laminate for additional fire retardancy. A 20-mil Nexus® veil, over-wrapped with 105 mils of chopped strand "E" glass mat, was used at the PVC/FRP interface.

CPF Dualam, Ltd., Montreal, was contracted for fabrication. According to Paul Habib, vice president & general manager, CPF Dualam, the scrubbers not only provide high efficiency, but also should afford a long service life.

MacKay notes that all interior hardware, including hold-down lugs, bolts, nuts and washers were fabricated with PVC and FRP. Featuring a packed tower design, the scrubbers' packing support plates are supported by internal beams also of dual-laminate construction. Packing support ledges and beam pockets are an integral part of each vessel.

The scrubbers were designed to withstand a 100 mph wind load with a 10-to-1 safety factor, and design parameters meet seismic zone 2 requirements. Pressures on the system include 5 psig at the header, and the design vacuum was 30" water gauge.

On a final note, the scrubber system, which has been in service since May 1992, is reportedly still in good operating condition with no problems to date, concludes Stewart of Boise Cascade. ■

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Made of a dual laminate of PVC and FRP, these scrubbers should afford a long service life, according to Paul Habib.

¹While DERAKANE epoxy vinyl ester resins offer properties which may inhibit ignition, all DERAKANE resins are organic materials. Products made with these resins will burn under the right conditions of heat and oxygen supply. Consult product literature to determine applicability of these resins to your particular project.