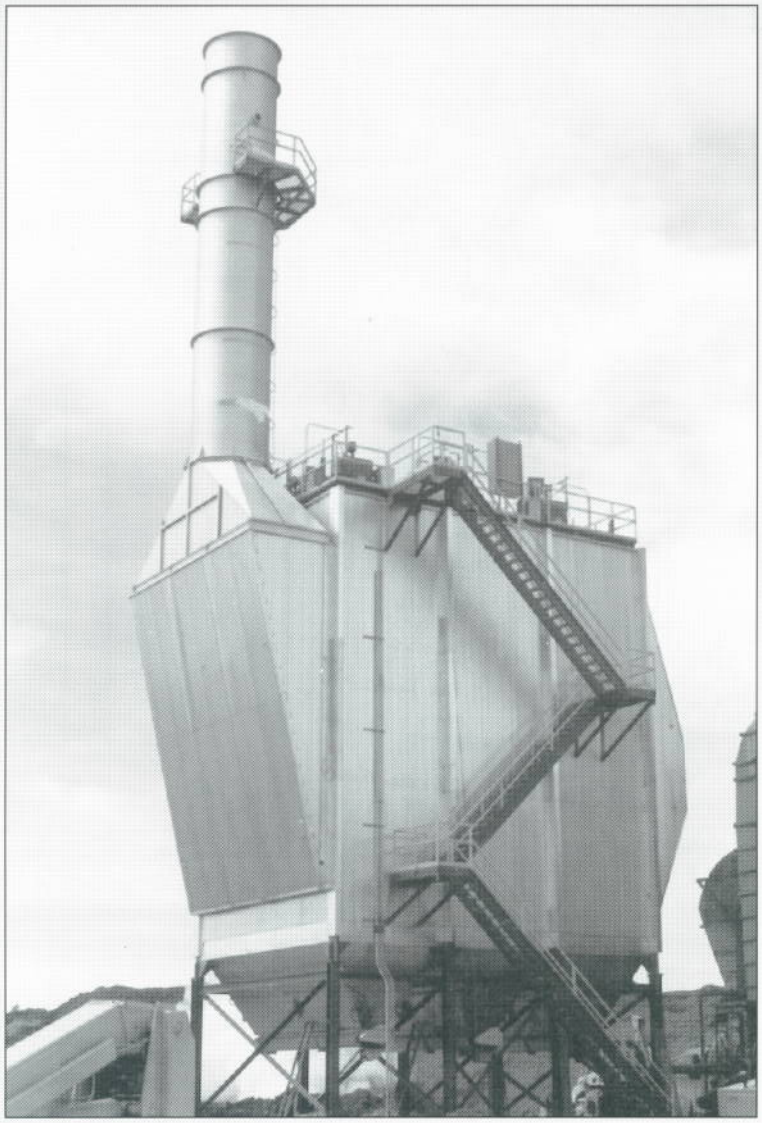
Precipitator Solves Dryer Problem

Plum Creek at Columbia Falls goes with PPC Industries' electrostatic precipitator on direct fired veneer dryers.

By Dave Weak and Gerry Graham

Plum Creek Manufacturing, Columbia Falls, Mont., installed a PPC Industries electrostatic precipitator to solve a direct fired dryer dust plugging problem. The electrostatic precipitator was installed in a very congested area and the project had to be done so the dryer was off-line a minimal amount of time. Plum Creek personnel relocated existing equipment, poured concrete footings, ran all of the field wiring, and a second contractor installed the ductwork. All facets of the project were completed on schedule and the operating unit has achieved the expected goals.



PPC has installed precipitators at several Plum Creek mills.

The Coe Manufacturing jet tube veneer dryers at the Plum Creek plywood plant are direct fired with a 25 mmbtu/hr Wellons wood fired fuel cell as a heat source. The fuel cell is followed by a blend chamber to cool the gases from 1800° to a usable temperature using recirculated air returned from the veneer dryers. Hot gases from the blend chamber flow through a Zurn multicone to remove some of the larger particulate and wood fiber picked up in the recirculation air (see Figure 1 for process diagram). Even with the multicone in the loop, the ash content of the flue gases was still sufficiently high to cause plugging of the orifices (jets) in the dryer tubes. Production was lost because of ash plugging the dryer jets. As the dryer jets plugged, the drying time increased and production dropped. The ash had to be manually removed with fire hoses from the veneer dryer. Cleaner flue gases were needed to stop ash plugging and regain the lost production from the dryer. The dryers had to be cleaned at least once every week.

A related problem was also caused from deposits of ash on the veneer left during the drying operation. The ash deposits caused a handling problem for plant personnel. If the dryer stopped too long, veneer would be badly discolored with ash and accelerated wear of mechanical parts of downstream machinery.

The most logical device for cleanup of the flue gas stream was an electrostatic precipitator. The advantages of low pressure drop, low power consumption and high efficiency overshadowed any other device. Limited fan capacity and downtime also favored the use of an electrostatic precipitator, since electrostatic precipitators have only 0.5" pressure drop and are low maintenance devices.

PPC Industries had built several electrostatic precipitators for Plum Creek Manufacturing at other plants. The units installed on hog fuel boilers have worked very well and have been very reliable. PPC personnel were sure an electrostatic precipitator would clean the gases, but weren't sure what other problems the electrostatic precipitator would introduce. This application was unique in that the flue gases were recirculated. It was unknown if the ozone from the electrostatic precipitator would build up and it was uncertain how this would affect the operation of the unit. Other unknowns were the high flue gas temperature and the high flue gas moisture. Finally, the level of removal was unknown since it was unclear how much particulate could be tolerated and still keep the orifices from plugging.

PPC had worked with another plant to develop a slip stream unit to remove most of the particulate. However, PPC opted for processing the entire gas stream because of the various unknowns. Gas flow was difficult to measure; however, the gas stream was finally tested to set the design flow rate and temperature.

Design/Installation

In the simplest terms an electrostatic precipitator is a large box. Dust laden gases are drawn into the inlet of the box. Inside, high voltage discharge electrodes impart a negative charge to the particles

entrained in the gas. These negatively charged particles are then attracted to a grounded collecting surface which is positively charged. The gas then leaves the box up to 99.9% cleaner.

Inside the box, particles from the continuing flow of gas build up on the collecting plates. At periodic intervals, the plates are rapped, causing the particles to fall into hoppers. The particles are then removed from the hoppers, usually by a rotary screw arrangement.

Once the gas flows and temperatures had been established, several designs and sizes of electrostatic precipitators were considered. The most promising was PPC's Model 17 electrostatic precipitator. It was guaranteed to meet an emission rate of 7.2 lbs/hr (about 0.020 gr/dscf).

The electrostatic precipitator was modularized to minimize field erection time. The pieces were quite large and presented a real challenge to install them in the limited area. The electrostatic precipitator was so large, and the area for installation was so small, several existing items had to be removed from the planned area. "Plum Creek even relocated the lunchroom". The erection area was a narrow one lane road between two buildings. Location of the electrostatic precipitator was to be in a wide part of the road. By locating the crane as close as possible to the electrostatic precipitator, the crane could only rotate a one-quarter turn. Since it was impossible to lift pieces in the conventional manner, all parts had to be brought to the crane on trailers or with a large fork truck.

The electrostatic precipitator was positioned so it would clear the existing outlet duct by only a few inches. The outlet transition was almost touching the existing duct when it was erected. The installation was so tight the conventional access ladder arrangement of PPC had to be scrapped and access from existing platforms were modified to get to the electrostatic precipitator roof.

Late delivery of key components delayed starting the job, so only five weeks were allowed for the erection. With only a three man crew (plus a crane operator), the electrostatic precipitator was completed ahead of schedule. The ductwork contractor was then able to install the inlet and outlet ductwork. The insulation of the ductwork was installed after the unit went on line.

The PPC startup engineer arrived early and performed a preliminary check of the transformer/rectifiers and other subsystems. The electrostatic precipitator was ready for flue gas while the ductwork was being installed. The dryer was brought online very slowly. Because of the high moisture content of the flue gas and condensation from heating the cool steel, the unit had large amounts of water running out of the conveyors. For this reason the final transport conveyor was omitted and the water and particulate were temporarily caught in barrels. One unexpected thing did happen—the pressure in the system exceeded the pressure provided by the purge air blowers and condensed flue gas water was also running out of the purge blower intakes and the bus ducts. PPC's startup engineer had the electrostatic precipitator online when this condition was discovered and de-energized the electrostatic precipitator. After the unit warmed up, the electrostatic precipitator was re-energized and operated normally. PPC's startup engineer stayed on site for another day and the unit continued to operate normally, but it was clear the purge air system needed more pressure. After a few hours of operation, the water stopped coming out of the conveyors and ash began to come out. Plum Creek's personnel replaced the purge blowers with a higher pressure fan to eliminate the problem of flue gas in the bus ducts during startup conditions.

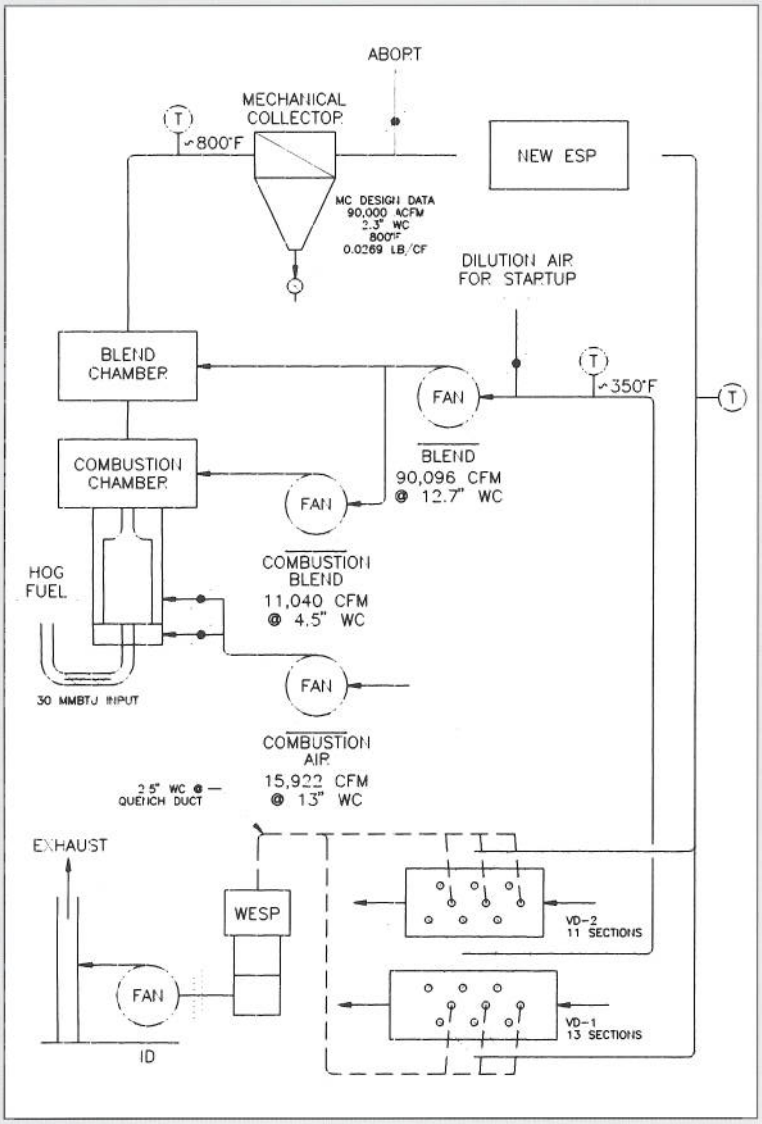


Figure 1: Recirculation process at Columbia Falls plywood mill

Operation

The electrostatic precipitator did what PPC expected—a very good cleanup of the flue gases. Discoloring of the veneer by the ash was no longer evident. Several checks of the area around the dryer revealed no ozone leaks. Concern that the electrostatic precipitator might lose voltage due to concentrating of the ozone did not develop—the unit ran very well. The usual loss of dryer capacity every few days did not develop.

The first inspection of the dryer revealed no buildup of ash in the dryer tubes. It was almost as clean as the day the electrostatic precipitator was started. After a few weeks of operation, flue gas began to escape around the seals on the conveyors. Clearly the seals would have to be improved. The only unresolved problem is the handling of the ash because of the high moisture content of the flue gas. The flue gases condense and make "mud" in the screw conveyors. In four months of operation, the dryer jets have not plugged. Some buildup of VOCs is occurring on the sidewalls of the dryers but nothing unmanageable. ●

Dave Weak is with Plum Creek Manufacturing and Gerry Graham is with PPC Industries, 3000 East Marshall, Longview, TX 75601/ 903-758-3395; fax: 903-758-6487.