Dust collection upgrades help drying plant clear the air

A California rice drying company installs compact, efficient bin vents to meet more stringent emissions standards.

While Van Dyke’s Rice Dryer Inc. has been owned and operated by the same family since being formed in the 1940s, the company isn’t afraid to make changes for the sake of its customers or the environment. When electricity prices had risen to 23 percent of the company’s total costs, Van Dyke’s responded by installing a 4-acre, 464-kilowatt solar power plant. The solar installation now offsets about 70 percent of the drying plant’s electric costs, allowing the company to keep its customers’ costs under control, and helping to reduce greenhouse gas emissions.

Located in Pleasant Grove, Calif., in the Sacramento Valley rice country, Van Dyke’s cleans, dries, and stores about 160 million tons of rice each year from about 45 local farms. Some is seed rice grown by local certified seed growers, but the majority is medium-grain rice sold to local mills or shipped to markets around the world.

During harvest, the company processes 100 to 140 truckloads of rice per day. “As the rice comes in from the fields, it has a lot of dirt, straw, and chaff with it,” says Van Dyke’s general manager Connie Jerome. The rice is fed through a continuous grain cleaner, dried in a propane-powered tower dryer, and then stored until it’s picked up for delivery. A dust collection system collects the dust and chaff that’s driven off the rice during cleaning and drying, and a local agricultural company picks up the collected material for use as mulch or cattle feed additive.

A steady stream of fine dust flows from the exhaust vent of one of Van Dyke’s seed facility cyclones before the company installed a new bin vent.
More stringent emissions standards prompt dust collection upgrade

The company had been using two baghouses and three cyclones to collect the dust in various plant locations. While the baghouses performed adequately, Van Dyke’s found that the cyclones weren’t able to meet new state and local particulate emissions standards. Additionally, a stream of fine dust that the cyclones couldn’t separate from the air flowed continuously out of the exhaust vents. It was clear that the time for change had arrived again.

One of the three existing cyclones was in a location called Plant 2, and the other two were in Van Dyke’s seed facility. The company decided to begin the upgrade with its Plant 2 cyclone. Van Dyke’s considered two options: running ductwork from the cyclone’s exhaust vent to a new baghouse installed on the ground nearby, or replacing the existing cyclone with a new baghouse. When the company’s local machinery fabricator learned about the company’s plans, the fabricator recommended installing a Donaldson Torit PowerCore bin vent directly on top of the cyclone. The fabricator explained that some of his previous clients had installed this equipment and were very happy with it.

This solution was appealing to Van Dyke’s because installing a compact bin vent would save space, reduce shipping and construction costs, and cut construction time compared to installing a new baghouse. The solution would also be more energy efficient because a bin vent mounted directly on the cyclone would require 30 percent less horsepower to operate than a baghouse. Van Dyke’s decided to take the fabricator’s advice and install a bin vent on the Plant 2 cyclone. “We were able to modify what we already had,” says Jerome. “This eliminated the need for additional framework and ductwork and helped us save space, time, and energy.”

Existing cyclone retrofitted with new bin vent

In July 2010, the company installed twin Donaldson Torit PowerCore CPV-16 bin vents on the 10-foot-diameter cyclone. The twin units function as one large bin vent and are driven by a single 16,000-cfm direct-drive fan. The bin vent contains a total of 32 nanofiber filters and has an automatic pulse-jet filter-cleaning system controlled by the supplier’s

Twin CPV-16 bin vents (dark blue) operate as a single unit with one controller to operate the pulse-jet cleaning system.
Delta P controller. One pulse-jet air valve is mounted above each filter.

Each filter consists of an oval “pack” formed of fluted nanofiber media layers and has a top handle to simplify installation and removal and an integrated, self-centering gasket to ensure a tight seal. The compact filter measures just 7.5 inches wide by 22.3 inches long by 7 inches deep but provides the same filtering area as six 8-foot-long traditional bag filters. “The filters are rated MERV 15,” says Randy Niley, Donaldson Torit’s district manager for Northern California and Nevada. “This is much more efficient than a conventional bag filter and offers much better discharge air quality.” The filters can be easily installed by one worker without tools, through a hinged hatch on the bin vent’s clean-air side.

To mount the new bin vent, the fabricator cut off the cyclone’s top just above the material inlet and installed a mounting adapter in its place. The bin vent was then mounted on the adapter, and ductwork was installed from the bin vent’s two clean-air exhaust ports to the fan on the ground. A compressed-air line for the pulse-jet filter-cleaning system was installed as well. “It took two workers four days to do the entire installation,” says Niley.

In operation, the fan draws dust-laden air from the plant’s dryer through the dust collection system’s existing ductwork to the cyclone. The air passes from the cyclone into the bin vent and through the filters, which collect the dust but allow the clean air to pass through the bin vent and out its exhaust ports.

The bin vent’s controller monitors the pressure drop (airflow resistance) across the filters. When the pressure reaches a preprogrammed high setpoint — indicating excessive dust buildup on the filters — the controller initiates a pulse-jet cleaning cycle. During the cleaning cycle, each air valve releases pulses of high-pressure air at the filter’s clean-air side, dislodging dust buildup and cleaning the filter media. The dislodged dust particles then fall to the cyclone’s bottom and collect in a bin below. The cleaning cycle continues until the pressure drop reaches the preprogrammed low setpoint. The controller’s high and low setpoints can range from 0 to 10 inches water gauge.

Compact bin vent delivers big results

The results of the upgrade were immediately clear. A dust stream no longer flowed from the dust collection system’s exhaust vent, and emissions levels were well within state and local standards. The company installed similar bin vents on the seed facility’s 12-foot-diameter cyclones the following year. Based on airflow requirements, Van Dyke’s retrofitted one cyclone with twin CPV-12 bin vents, each powered by a 15-horsepower direct-drive fan, generating a total airflow of 11,000 cfm. The company retrofitted the other cyclone with a single CPV-16 bin vent with a 20-horsepower direct-drive fan, generating 7,500 cfm.

Thanks to the new bin vents, Van Dyke’s has no problem meeting emissions standards, and the air around the plant is clear. Because a bin vent is so much smaller than a baghouse, shipping and installation costs were less than they would have been if the company had chosen to install baghouses.

“Van Dyke’s also modified its seed facility cyclones (white) to accept the new bin vents (dark blue).”

Also, compared to the time-consuming and labor-intensive process of changing traditional bag filters, changing the compact bin vent filters is quick and easy, reducing maintenance costs. “It’s very simple to change out the filters,” says Jerome. “We open the unit and remove the old filters and put a clean set of filters in. There’s no downtime.”

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Note: Find more information on this topic in articles listed under “Dust collection and dust control” in Powder and Bulk Engineering’s article index in the December 2014 issue or in the Article Archive on PBE’s website, www.powderbulk.com. (All articles listed in the archive are available for free download to registered users.)

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