Case history

Dustless bag-filling system puts material in, takes dust out

A company installs a dustless bag-filling system to reduce fugitive dust and improve production.

Western Pozzolan Corp., Doyle, Calif., extracts natural pozzolan (also called *Lassenite Type N natural pozzolan*) from a surface mine located in Lassen County, Calif. The company trucks large pozzolan chunks to its plant near Doyle and grinds, screens, and packages the material for use as a soil amendment for reducing the irrigation requirements of lawns, gardens, golf courses, and other sports and agricultural fields. In the past, the company used a top-loading gravity-discharge bagger to package the pozzolan in 25-pound plastic bags. However, the bagger produced excess fugitive dust that pervaded the plant, increasing housekeeping and production costs and creating potential operator safety issues. The bagger was also slow, filling just 5 bags per minute. To solve these problems, the company worked with a supplier of a new dustless bag-filling system.

Demand for pozzolan grows

Pozzolan is a finely divided, siliceous and aluminous amorphous mineral with unique water-absorbing qualities. "Pozzolan has been used for centuries as a cement additive," says Steve Beck, Western Pozzolan president. "For example, the Romans used to mix certain natural pozzolans with lime to produce cements with various properties, such as the ability to harden under water. But in modern times, as the use of fly ash became more prevalent as a cement additive, the pozzolan industry faded because it cost too much to produce compared to fly ash, which is basically a waste product of coal combustion."

However, new market opportunities have revitalized the pozzolan industry over the last several years. Since pozzolan is extremely porous and absorbent, water efficiently soaks into and slowly discharges from it, making pozzolan ideal for use as a soil amendment for reducing irrigation requirements. "Currently, a large market exists in the Middle East where it's used for sports fields, golf courses, and other agricultural purposes," says Beck. "By putting about three to five percent pozzolan into a field's root zone, we can reduce irrigation requirements by at least thirty-five percent and sometimes more than fifty percent. The pozzolan can also be saturated

An operator slides the self-sealing valve bag's opening over the dustless bag-filling system's nozzle.

with liquid fertilizers and other nutrients that are slowly released into the root zone to promote better growth."

Problems packaging the pozzolan

After extracting the pozzolan from the Lassen County surface mine and trucking it back to the Doyle plant, the company sends it through a primary crusher to reduce the large chunks to more manageable sizes. A conveyer moves the pozzolan discharged from this crusher to a secondary crusher that reduces it to a top size of about ¾ inch. The crushed pozzolan is then conveyed to a screening operation that classifies it into a variety of desired particle sizes. From the screening operation, the pozzolan grades are conveyed to a kiln for calcining or to dedicated silos for storage before packaging.

When the plant first began operations, the company was using a top-loading gravity-discharge bagger with a vertical discharge spout to package pozzolan grades in 25-pound plastic bags. However, the bag-filling operation caused several problems. As the bagger filled the bags, fugitive dust escaped and permeated the plant. Because the plant's central dust collection system couldn't capture all of the dust, the operators had to wear goggles and special respirators to prevent dust inhalation. And since the dust would eventually settle on the equipment and plant floor, the operators had to spend extra time cleaning it up and checking the equipment parts to ensure that they remained dust-free. "The bag-filling operation was also very time consuming, which reduced our production capacity," says Beck. "So as business increased, these problems not only increased our housekeeping costs and concerns for the operators' safety, they also increased our production costs. To keep our operation viable, I realized that we needed to find a way to fill the bags without generating so much fugitive dust."

Solution presents itself

In summer 2005, an engineer from Bag Fill Systems LLC, Sacramento, Calif., visited the Doyle plant after hearing about the plant's operation and dust problems. The engineer asked Beck if the supplier could test its newly developed dustless bag-filling system in the plant under working conditions to demonstrate its effectiveness at virtually eliminating fugitive dust. If Beck was satisfied with the results, the pozzolan company could then lease the system.

After learning that the bag-filling system is designed for use with most available air-packer bag fillers, Beck told the engineer that the plant had two St. Regis 714 air packers, each with a mechanical scale, sitting idle in storage and that the supplier could use one for the test. This air packer uses high-velocity low-pressure air to move material into a bag through a horizontal discharge spout.

For the test, the supplier contracted Choice Bagging Equipment Ltd., Taylor, Tex., to retrofit one of the St. Regis air packers with a bag-filling system and connect the plant's central dust collector to the system. The complete setup took about half a day and required no modifications to the air packer's blower system.

The dustless bag-filling system

The supplier's Clean-Fill System for dustless bag-filling consists of a Clean-Fill Nozzle that discharges material into 25-pound custom-designed Clean-Fill Bags. The nozzle consists of two concentric 18-inch-long abrasion-resistant steel tubes mounted inside one another. The nozzle's outer tube is connected to the plant's central dust collection system, and its inner tube is connected to the air packer's rubber discharge tube. The flow of material and air through the discharge tube is controlled by a pinch valve that squeezes the tube shut to stop flow.

The mechanical scale supports the bag as the air packer fills it, minimizing the need for operator assistance.

The nozzle's outer tube is connected to the plant's central dust collection system, and its inner tube is connected to the air packer's rubber discharge tube.

"To retrofit the air packer, we just removed the existing nozzle, mounted our nozzle in its place, and properly connected the tubes. It's that easy," says Don Pansier, Bag Fill Systems vice president. "The nozzle, which is designed to handle the abrasive pozzolan, can be constructed of materials to meet food-grade operation requirements.

We're also currently developing a nozzle that can handle much larger materials, such as charcoal or coal."

The weather-resistant self-sealing plastic valve bags, made by Balcan Plastics/First Film Extruding, Montreal, are custom-designed, -manufactured, and -sized to maintain a specific shape when filled with 25 pounds of pozzolan with a known bulk density. About ¾ of the bag top is sealed and the remaining ¼ is open. The opening has a self-sealing valve consisting of two plastic flaps that remain inside the bag. The bags are made individually and can be made in any shape and size to hold any material type and amount. The bags, which can be any color of plastic, can have integral handles for easy lifting and handling and can be printed with words and photo-quality graphics and logos.

The bags arrive at the Doyle plant stacked in a large box. "Since the plastic bags are thinner than paper bags, four times more plastic bags can be stacked in the same size shipping box than paper bags, which means more bags can be inventoried in less storage space," says Roger Tambay, Balcan Plastics/First Film Extruding vice president of business development. "Also, because the individual bags are self-sealing, expensive bag-cutting and form-fill-seal equipment isn't required, which reduces a plant's operation costs and floor space requirements."

To fill a bag, an operator inserts the nozzle into the bag opening and releases the air packer's pinch valve. The air packer's mechanical scale supports the bag as it's filled. About 2 seconds later when the scale registers 25 pounds, the air packer automatically closes the pinch valve, and the operator removes the bag from the nozzle. As the material inside the bag settles, it forces the flaps closed, completely sealing the bag and preventing dust from escaping. The operator places the bag on a belt conveyor that moves it to a staging area near a pallet for manual palletization. "The bag's valve is similar to a basketball valve,

After removing the bag from the nozzle, the material in the bag settles, forcing the valve flaps closed and sealing the bag to prevent fugitive dust.

which uses the air pressure within the ball to seal the valve shut," says Tambay. "With this bag, you can insert an air hose, fill up the bag, remove the air hose, and the bag will stay inflated so that you can bounce it like a ball."

As a bag is being filled, the dust collection system constantly removes the displaced air and dust from the bag via the nozzle. From the nozzle, the air and dust are first pulled into a sealed metal container housing a dust filter that captures minute dust particles. The dust collection system pulls the air from the drum and filters out any remaining dust particles before exhausting the clean air to the atmosphere. "This setup allows the company to reclaim the material pulled from the bags," says Pansier, "and provides a secondary product at virtually no cost since the company doesn't have to use expensive size reduction equipment to achieve the small particle sizes. Currently, the company is testing the reclaimed material to determine which industries to market it to."

Success flows into bags without dust

Since using the dustless bag-filling system and self-sealing valve bags, the plant's bagging operation is cleaner, requires less labor, and is more productive. "The primary reason for installing the bag-filling system was to reduce operator health and safety issues caused by the fugitive dust, and it's done that," says Beck. "Our operators no longer have to wear protective gear because the dustless system has virtually eliminated the fugitive dust from the plant. Housekeeping costs have also decreased because operators no longer have to clean dust from the equipment and plant floor as often. Additionally, the dustless system has helped increase equipment operating life by drastically reducing the fugitive dust that can get into equipment bearings and other parts and muck things up. At this point, we're very pleased with the bagging operation because the bag-filling system is easy to use and the self-sealing bags are easy to handle."

The dustless bag-filling system and self-sealing valve bags have decreased the plant's production costs and improved its production capabilities. "We can fill about fifteen bags per minute now with about any size material, which is more than double what we could handle in the past," says Beck. "And since the supplier's system performed so well during testing, we decided to lease it and use it permanently. In fact, we have another air packer in the bone yard, and, as product demand increases, we plan to retrofit it with the supplier's nozzle and add it to the production line. The second air packer will have a nozzle that can handle large-grained materials, so we can keep both lines running without having to switch nozzles for different material sizes." **PBE**

Note: To find other articles on this topic, look under "Bagging and packaging" in *Powder and Bulk Engineering*'s Article Index at www.powderbulk.com or in the December 2005 issue.

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