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CASE HISTORY

Increase bag life
Reduce pressure drop

Baghouse vibrators keep steel production levels steady

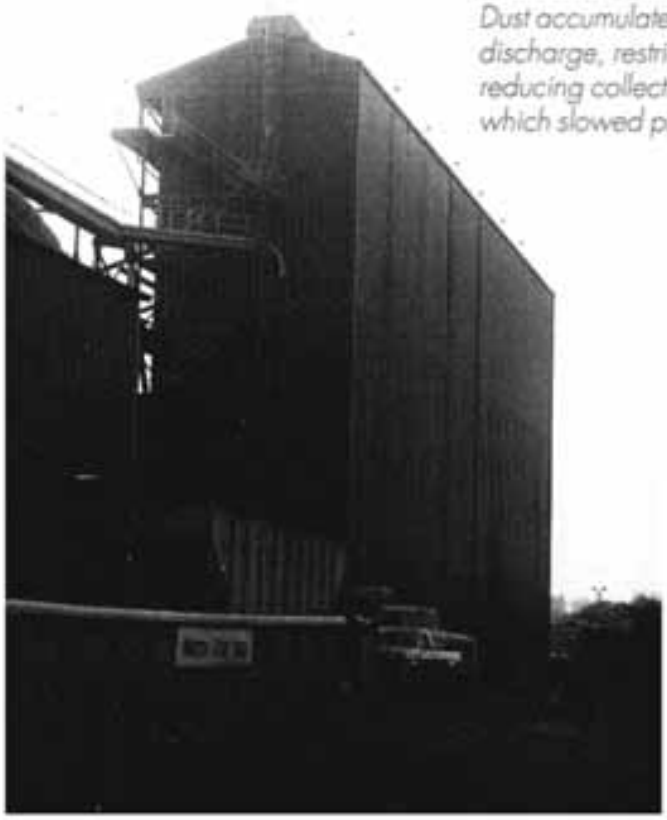
When baghouse dust buildup slowed steel production, installing vibrators returned levels to normal.

North Star Steel Co., St. Paul, Minn., a subsidiary of Cargill, operates ten facilities nationwide for steelmaking or rolling steel. The steelmaker's St. Paul mill produces high-quality carbon steel and alloy steel rounds for the construction industry and makers of industrial equipment. The raw materials consist of about 70 percent prompt industrial scrap (unused industrial scrap steel) and 30 percent frag (fragmented used scrap steel). The steelmaker produces about 90 t/h of steel.

The steel scrap is melted in a 90-ton DC electric arc furnace that vents through a reverse-air baghouse to remove fine dust particles from the exhaust. The dust collects in the baghouse's seven modules. Each module contains 336 bag filters (or bags).

Dust buildup restricts baghouse efficiency

In the baghouse, the vertically mounted bags' bottoms are clamped to a tube sheet. In the past, moisture from the frag and from water-cooled ductwork added moisture to the furnace exhaust. The moisture caused dust to accumulate around the inner circumference of the metal tubes at the bags' discharge. The dust would



Dust accumulated at the bags' discharge, restricting airflow and reducing collection efficiency, which slowed production.

Shown here is 1 of 21 vibrators installed on the tube sheets to keep dust from building up.

eventually close off some tube sections and back up into the bags, which restricted baghouse airflow and increased pressure drop, reducing collection efficiency.

"With decreased baghouse efficiency, we couldn't fully exhaust the furnace, so we had to slow production," says maintenance foreman Gary Wettern. Sometimes production slowed to a near standstill. "There were a couple of isolated incidents where it got that bad. I did everything I could to avoid shutting down, and we didn't have to. But it caused us to cut back on production."

In addition, when baghouse efficiency dropped, North Star noticed more dust inside and outside the plant. This resulted in added chores as workers had to spend more time on housekeeping.

Steelmaker tries vibrator on tube sheet

To keep production at normal levels, North Star considered ways to keep dust from building up inside the bag discharge tubes. "We tried sonic horns, but we really didn't give them a fair chance. When we tackled the problem, the dust was already built up," Wettern says. "The horns are designed to avoid buildup; they work better as a preventive step."

North Star had been using a type of bin vibrator for a different application in their plant for several years. "We had used the vibrators in another baghouse to remove material from hoppers," Wettern says. "So we decided to try the same type of unit in the furnace baghouse." For the furnace exhaust application, Wettern got a trial unit from the manufacturer's local representative, TeamPro Engineering in St. Paul. Wettern mounted the vibrator on the tube sheet to dislodge the buildup at the bags' discharge.

The trial unit successfully removed the dust buildup. North Star concluded that a single vibrator could maintain an area that would take numerous sonic horns to keep clean and decided to install three vibrators in each baghouse module.

Multiple vibrators are installed in baghouse

In 1995 North Star installed 21 model BH 2 impacting vibrators on the baghouse tube sheets. The BH 2 has a 2-inch pneumatic piston. Because the plant's airline lubrication system was limited, the vibrators' piston and bore were Teflon-coated to extend their life.

After baghouse efficiency dropped, North Star noticed more dust inside and outside the plant.

To drive the piston back and forth, compressed air is alternately directed from one end of the piston to the other. The force causes the piston to sharply strike the base of the bore on each cycle, creating the vibration. The vibrator housing is a one-piece ductile iron casting, and the piston is the vibrator's only moving part.

The 2-inch impacting vibrator solves light- to medium-duty bulk material flow problems. It operates at a frequency of 4,750 vibrations per minute. The vibrator weighs 20 pounds and can be used on vessel wall thicknesses from ⅜ to ¼ inch. Its air consumption is 8.3 cfm at 50 psi, and its noise level is 106 dBa. The vibrator is also available in a *silent* model, which has an air-cushioned piston and a noise level of 73 dBa. The manufacturer recommends the silent model for light-duty applications with noncohesive or free-flowing materials.

"We tied the vibrators' operation in with the [baghouse] clean cycle," Wettern says. "The vibrators are active for 60 seconds each hour. They vibrate the tube sheet, causing the dust to fall, preventing buildup."

Production levels return to normal

With the vibrators mounted on the tube sheets, North Star Steel has seen a definite improvement in operations. Eliminating dust buildup maximizes airflow, which increases baghouse collection efficiency and allows normal production levels.

In fact, Wettern says the vibrators work *too* well sometimes. "If you don't monitor the air-to-cloth ratio carefully, the baghouse will draw too much air. And the air oxidizes the graphite [used to make steel], which causes graphite overuse," Wettern says. When that happens, the steelmaker reduces the baghouse fan capacity via the inlet damper to compensate. As a result, they save money on electricity.

Besides keeping production levels on target, the vibrators help keep the plant much cleaner. Dust is eliminated inside and outside. "We continuously show zero emissions from the baghouse and the melt shop; that's an important improvement," Wettern says.

Wettern is still working on perfecting the system. "The vibrators occasionally loosen from the mounting brackets we installed and have to be tightened. And it takes some effort to keep the vibrators lubricated," he says. But overall, he's very satisfied. "I would recommend them to anyone having a similar problem with dust buildup." **PBE**