

Solve common coal-handling problems



Controlling dust, reducing energy losses as coal travels from source to furnace, and dealing with harsh weather topped the list of challenges discussed at a recent user meeting

Broad challenges facing coal-handling system operators in today's market include fuel flexibility, more precise fuel preparation required by low-NO_x burners, continued emphasis on reliability and availability, and low-cost production. Specific problems and solutions in these areas and others were addressed at a recent users seminar sponsored by Svedala Bulk Materials Handling, Pittsburgh, Pa. Highlights are presented here.

Dust busters

Dust control is of great concern to those handling Powder River Basin (PRB) coals. It is essential for protecting against fire and environmental impact, and for reducing energy losses that result from oxidation when coal travels from the mine to the boiler. Northern States Power Co's (Minneapolis, Minn) Sherburne County (Sherco) plant staff reported that, through an appropriate choice of chemicals and water application, they can efficiently control dust and simultaneously reduce oxidation losses.

Sherco consists of two 750-MW tangentially fired units and one 850-MW wall-fired unit. The tangentially fired units are

equipped with wet limestone scrubbers, the wall-fired unit is equipped with a spray-dryer scrubber and fabric filter. The units burn subbituminous PRB coal from Montana and Wyoming. Though similar in heating values and ash content, the coal from each mine differs markedly in ash quantity and composition, sulfur content, dustiness, and spontaneous combustion characteristics, notes John Lehto, principal production engineer.

Coal is unloaded into track hoppers by a rotary car dumper. Feeder belts meter the coal from the track hoppers onto a conveyor where an aqueous solution of dust sup-

pression chemicals is sprayed onto the coal as it falls onto the conveyor. At each transfer point, the coal stream is enclosed in chutes. Collection systems deliver the dust-laden air to fabric filters. Coal dust is returned to the conveying system and sent to the boilers.

Chemical suppression keeps dust levels acceptable. A surfactant increases the wetting properties of the water to better capture dust. For short-term (less than one day) suppression, water can reduce dust effectively. For coal that will be stored for several days, a chemical binder is often applied to keep the dust particles attached to the coal after the water has evaporated.

Over the last 20 years, coal oxidation losses at Sherco have averaged about 1.5% of purchased energy content, or roughly 30¢/ton of coal. Plant personnel have found the rate of oxidation varies dramatically with the amount of water added and with the choice of chemicals used for dust control. Sherco has tested combinations of different binders and surfactants. Depending on the mix, oxidation rates can vary as much as 300%.

After several unsuccessful attempts at measuring oxidation that were often either too complex or time-consuming, or required exotic equipment, Sherco found a satisfactory technique. Gas sampling for O₂ and CO proved to be a simple method that indicates oxidation rates over periods of one to four days—the normal storage times for coal at the plant.

Several assumptions, howev-



er, are required to analyze these data. The results are not highly accurate, but the technique is practical for measuring relative oxidation, and according to Lehto, they agree with average energy losses experienced over the last 20 years. Plant personnel calculate the volume of air in "test cans" and the volume of O₂ depleted during the test period, which gives the percentage of the coal's original energy content that has been destroyed by oxidation. The coal loses about 0.2% of its energy in 24 hours. All tests compare two or three samples from the same train load.

To those considering this technique, NSP offer these suggestions:

- Take all samples from the same train to make comparisons—coal from the same mine will vary depending on how long it has been out of the ground and what type of weather it has traveled through.

- Treat the coal with the same application equipment that is used for coal entering the plant; small samples treated manually are not representative of the actual coal entering the plant.

- Take many small samples, mix them, and extract a composite sample to better characterize the coal.

Coal quality affects handling

American Electric Power Co's (AEP, Columbus, Ohio) coal handling systems were designed from as early as the 1930s and as recently as the 1980s. Swadhin Chakraborti, senior engineer, Operations Services, reports that AEP has developed some tactics for mitigating the impact of raw coal size and weather conditions on its handling systems.

Conveying dry coal generates more dust at the transfer points, dust blows off from the coal piles, and spillage occurs between the conveyor's seal skirt and the belt. Accumulated dust increases risk of fire hazard, especially with western coal. Collectors and suppression systems work in concert to control dust.

When the coal is too wet, however, coal fines stick together and flow less easily, creating numerous plugging problems. This in turn causes coal to build up inside the crushers and chutes and underneath the belt cleaners and rollers. Very wet, fine coal can create a thick slurry-type substance, which reduces the friction necessary for efficient conveyor operation.

Several measures minimize problems



associated with dry and wet coal fines. These include:

- Reducing belt speed and increasing belt width.

- Using fire-retardant conveyor belts (depending on coal type and application location).

- Properly designing skirtboard seal, baffle plate/centering plates at loading zone, and belt-cleaning system.

- Using a self-cleaning screening system.

- Improving the dribble chute/dribble screw conveyor to better handle the return carryover.

- Taking flow and wear into account when designing chutes, hoppers, bunkers, and silos.

- Installing an appropriate washdown drainage system.

Frozen coal creates big handling problems. During subfreezing temperatures, the surface moisture in coal—along with any precipitation—freezes, forming an ice crystal matrix which is difficult to break. Handling problems can be expected when surface moisture exceeds 5%. Coal being shipped has a wide particle size distribution and contains an appreciable amount of material smaller than 1/16 in. Greater fines content, combined with surface water, results in more particle-to-particle contact, packing, and freezing.

Frozen coal thus becomes very hard and dense as it continues to be exposed to freezing conditions during shipping. In-plant handling problems associated with frozen coal are unloading it from rail cars, slippage from frozen conveyors, and freezing and attaching to conveyors, chutes, silos, and bunkers.

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