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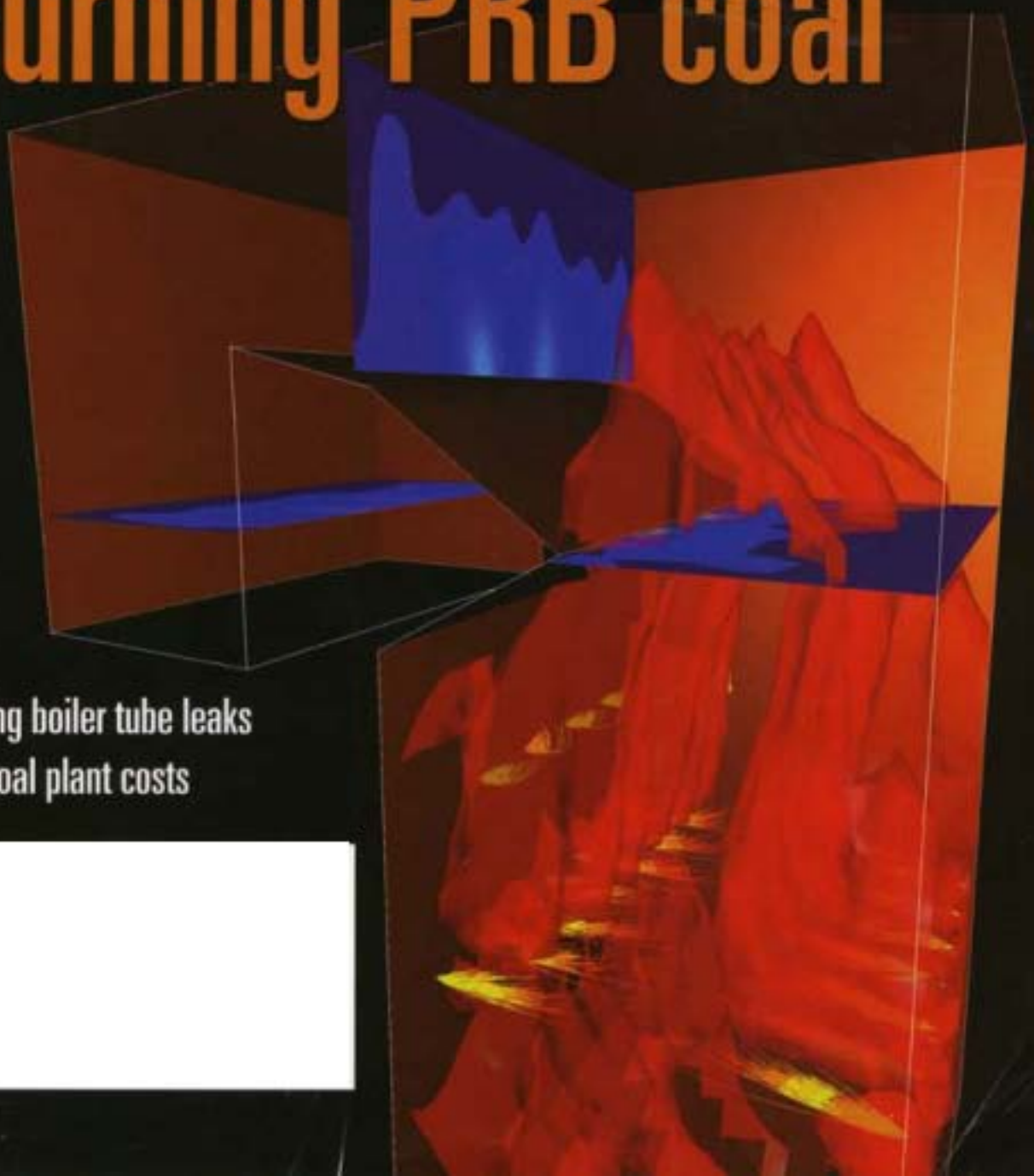
Burning PRB coal



Benchmarking boiler tube leaks

Estimating coal plant costs

junction compensation. If the integrity of the cold junction is not carefully maintained, then the measurement may be inaccurate, potentially leading to false alarms or—worse—false peace of mind for operators.

Another alternative to CO monitoring is the infrared (IR) temperature sensor. Unlike thermocouples, IR sensors are durable and designed to resist corrosion and damage in the mill. But although they are tolerant of dust and condensation, their lenses require frequent cleaning to maintain the accuracy of temperature measurements. In terms of fire detection, IR sensors are faster than thermocouples but slower than CO detectors. For use in a coal mill, IR sensors have a major problem: They only react to a spark or flame within their field of view. Due to this "blindness," their fast response may be irrelevant.

Because many mill fires occur under the grinding table, IR temperature sensors often are placed there. But if they are to be used under the grinding table (or elsewhere in the mill), they must be accompanied by multiple cameras to expand their view of the area, which increases deployment costs significantly. By comparison, a single CO monitor would be cheaper, more accurate, faster, and safer.

*—**Contributed by Land Instruments International** (www.landinst.com), a designer and supplier of combustion, environmental, and temperature monitoring systems to the worldwide power generation industry.*

MATERIAL HANDLING

Dustless railcar unloading station

One of the biggest O&M challenges at PRB coal-fired power plants is controlling dust at coal-transfer points. Several traditional technologies have been tried as solutions to this problem with varying degrees of success. A particularly difficult issue is how to control dust from large open-dump pockets like roll-over rail dumps.

Under the guidance of coal yard supervisor Gary Taylor, Basin Electric Power Cooperative's Laramie River Station in Wheatland, Wyoming, decided to take a proactive approach to the problem. Laramie River Station burns 100% PRB coal in its three 550-MW units. According to Taylor, "We had used dust collection and chemical dust suppression systems with limited success. In addition to better dust control, we wanted lower O&M costs."

Creative accounting

In 1999, Taylor located a firm that supplies dry fog dust suppression systems—Dust Solutions Inc. (DSI). DSI has two regional offices—in Bluffton, S.C., and Vancouver, Wash.—and a web site with a very appropriate URL—www.nodust.com. Taylor's first concern was in the reclaim feeders under the storage silos. Airborne dust levels and cleanup costs were higher than desired, so he decided to try DSI's dry fog technology in this area first. Based on the results in the reclaim feeds, Taylor realized that he had to put the technology to work in other parts of the plant as well, which he did over the course of several years. "To do so," he explained, "I used my annual budget for dust suppression chemicals to buy a permanent, nonchemical solution to dust problems."

In 2003, after installing additional DSI dry fog systems at the plant's fuel bunker loading galleries and ash discharge silos, Basin Electric requested quotes for the supply and installation of a dry fog system for Laramie River's rotary rail car dumper. The original dust collection system had been abandoned many years earlier and replaced with a wet chemical surfactant-type system from another vendor.

According to Taylor, "The collection system was overwhelmed by the amount of dust created by the dumping. The chemical system was somewhat effective, but it had several drawbacks, including recurring chemical costs and the inability to operate during Wyoming winters, which made the wet chemical system inoperable during several months of the year. In addition, we knew that they were adding significant amounts of water to the coal, which needed to be driven off, creating a Btu penalty."

In 2003, Basin Electric's engineering department wrote a comprehensive request for proposals for a dry fog system at Laramie River's train car unloading dumper. DSI and the company's preferred installer—Acrotech Services Inc. (Bismarck, N.D.)—received the award and started work in the late summer of 2003. Because dry fog systems require a source of compressed air, Basin Electric decided to build a dedicated room to house the air compressor, air receivers, and the base components for the fog system.

Acrotech Services worked around the train-unloading schedule to install fogging manifolds at three strategic points above the dump pocket grizzly (Figure 3). According to Acrotech's project manager, O'Dell Jesser, "The system's modularity minimized field installation time and cost. We were able to install most of the equipment in a matter of days with no unscheduled shutdowns."

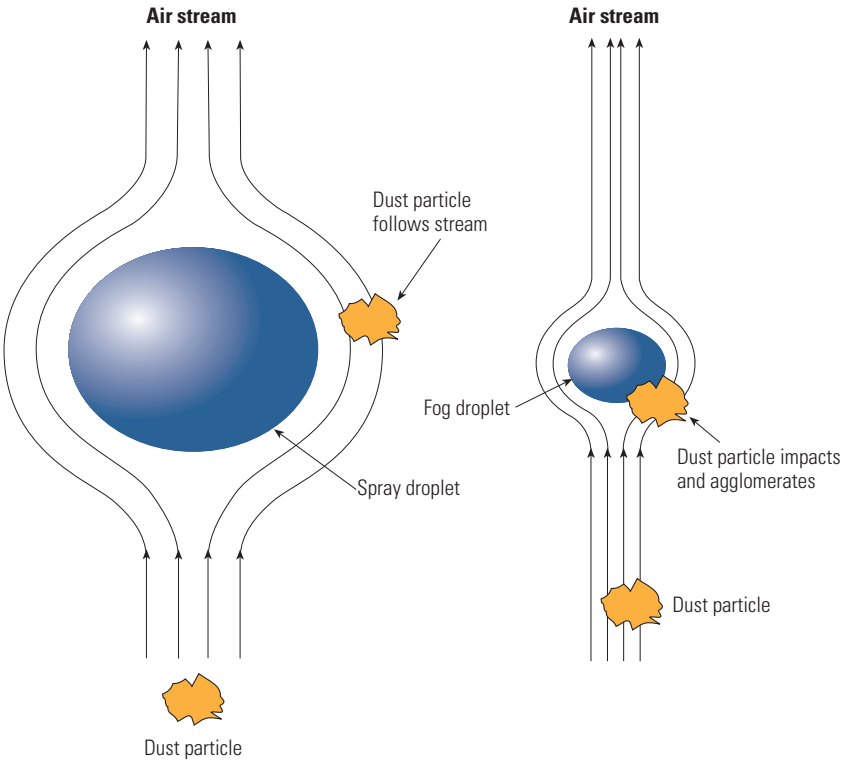
How dry fog suppresses dust

David Gilroy, product manager for Dust Solutions, added, "Dry fog is designed to be sprayed into the air in the area of dust creation. It is not designed to wet the coal being dumped; only the air-

3. Breathe easy. Three strategically placed fogging manifolds were placed above the dump pocket grizzly to reduce dust emissions. *Courtesy: Dust Solutions Inc.*

borne dust particles are wetted, making them stick to other slightly wetted particles [Figure 4]. This principle is similar to how nature cleans the air. The increased mass of the agglomerated particles make them fall out into the dump pocket almost instantaneously [Figure 5]."

4. Play misty for me. The size of the mist particles is closely matched to the size of the coal dust particles to maximize particle impact and removal efficiencies. *Source: Dust Solutions Inc.*



5. Matched set. Maximum removal efficiency occurs when the mist droplets are generated at the same rate as the dust particles and applied at the point of dust creation. *Courtesy: Dust Solutions Inc.*

The most harmful and hard-to-remove airborne dust particles are between 1 and 10 microns across—too small to be affected by typical high-pressure water or chemical suppression sprays. If the droplets are larger (like a mist of 20- to 50-micron particles), a slipstream effect will prevent dry fog from impacting them and result in little if any suppression. The system is designed with a unique air atomizing nozzle to create a true fog; 98% of the droplets are 1 to 10 microns across. A fog droplet and a dust particle must be of similar size if they are to impact.

With dry fog systems, water addition is typically less than 0.05%. This was the case with Laramie River's rail dump, which used a maximum of 14 gallons of water per 120 tons of coal dumped. Compared to the 144 gallons of water from the old spray system, this represented a 1,000% reduction in water use.

Another nice characteristic of the fog droplets: They lack sufficient mass to freeze. To protect the dry fog system, water supply lines and control cabinets are heated and insulated, and water lines are automatically purged with compressed air during shutdown.

According to Taylor, "The results have been excellent. We tested the system's efficiency and found that we were able to reduce dust levels by 96% or more—well above the specifications requirements. We even have several operational options for the fog system. For example, we can adjust fog output to match the amount of dust generation. This allows us to minimize the amount of compressed air and water usage. I just wish I had located DSI sooner."

—Contributed by Dust Solutions Inc. *(www.nodust.com).*

FIRE PROTECTION

Testing fire sprinkler systems

A power plant is a complex facility comprising many different—and expensive—mechanical systems. Turbines and transformers can cost millions of dollars, and if a replacement is not on hand, one can take months to replace. In the interim, millions of dollars in generation revenue can be lost. It's easy to see the value of such equipment. But aren't the safety systems that protect the equipment just as valuable?

Fire-suppression systems, like most mechanical systems, require periodic maintenance to ensure that they contin-