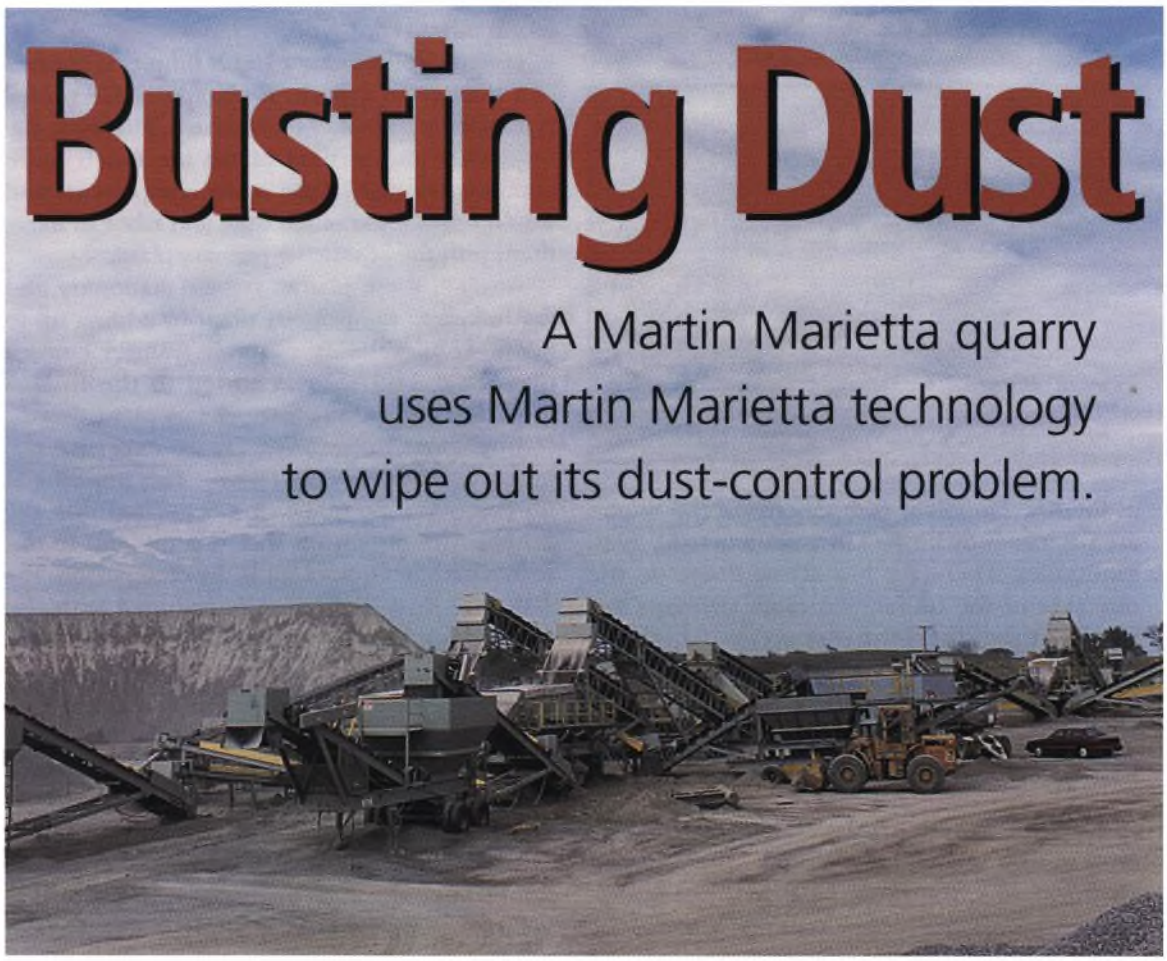
PIT&QUARRY

E&T DUST CONTROL

Busting Dust

A Martin Marietta quarry uses Martin Marietta technology to wipe out its dust-control problem.



Midwest states have very strict fugitive dust laws.

Bill Gahan
Martin Marietta Aggregates

By Rodney E. Garrett

Dust control is an operational problem that many quarries face each day. With federal regulations threatening to tighten, and with a continuing emphasis on silicosis in quarry operations, dust control is becoming more and more of an issue. There are a number of dust-control methods on the market, from spray wash bars to chemical foam systems.

Mobile dust-control is yet another step forward for the aggregates industry in its fight against fugitive dust. Martin Marietta Aggregates, Olathe, Mo., received just such a unit in early 1995. It was added to a new portable crushing/screening plant purchased by the company. The 700-st/hr capacity plant is used for producing rock products on location throughout the Midwest.

The crushing/screening plant was designed by G.W. Van Kepple, Kansas City, Kan. Considering the size of the plant, it is designed for efficient transporting. To illustrate, Martin Marietta's superintendent, Tom Bolyard says the plant was recently made road-ready, transported 130 miles to its present location (Severy, Kan.) and made production-ready all in three weeks.

The mobile dust-control system adds inconsequential prep-time for transporting it with the plant. Actually, the system is always both road-ready and production-ready. For example, to transport it you only have to disconnect the external utility leads, which feature quick-couplers, and hook a tractor to the semi-trailer that contains the system.

The mobile dust-control system was designed and built by Martin Marietta Magnesia Specialties Inc., Baltimore, Md. The system includes the field-proven technology used in the company's Dust Buster system.

A brief description of the mobile dust-control system is

With the dust-control system turned off (top) the operation produces a cloud of fugitive dust. With the system turned on (below), the air is much clearer.

as follows: The main components of the system are permanently housed in a tandem axle, 40-ft. semitrailer. There are two access doors on the one side of the trailer. Portable stairways are placed at the doors for easy access. There are two 2000-gal. chemical-resistant polypropylene tanks anchored to the floor near the trailer's end section. A special liquid foaming agent – CDS-80 – manufactured by Martin Marietta, is stored here.

Near the middle of the trailer is an operations cluster including: a positive displacement chemical metering pump, a centrifugal pump, shut-off valves (including remote-control solenoid valves) pressure gauges, and pressure and volume controls. At the front of the trailer is a 2-stage air compressor rated at 60 cfm at 100 psi.

The compressor is mounted on a 120-gal. receiver. The trailer is prewired for supplying power to all the equipment and lighting fixtures. There is a distribution and main fuse box for receiving a 460-volt x 30-amp, 3-phase outside mains power supply.

Two 3-KVA step-down transformers are used for supplying 120v/single-phase electrical power to the lighting fixtures, two electric heaters, and a heat trace for the chemical and water pipelines. As already mentioned, all the system's utility lines are connected to the outside lines with quick couplers.

Twice as nice

Martin Marietta actually uses two mobile dust-control systems for the new portable plant. The reason being, the primary crusher is near the face of the quarry and is moved, with one of the dust control systems, as the excavated quarry face is advanced.

Moving the primary plant is simple. It consists of a 1,000-st/hr capacity Cedarapids 5348 primary impactor mounted on a chassis. However, the secondary and tertiary plants are much more complex because of the many components and would require too much time and labor to move them with the advancing primary plant.

Instead, these plants remain stationary and are linked to the primary plant by adding up to eight, 42-in. x 100-ft. portable transfer conveyors. Each conveyor is added to the link as required by the advancing primary plant.

Impactors notoriously create excessive airborne dust when in operation. This impactor is no exception. So much dust is created with the dust-control system off that it is difficult to discern what the equipment is. By comparison, the airborne dust is drastically reduced with the dust-control system operating.

Primary dust control

A five-spray-nozzle manifold is mounted at the mouth of the grizzly for spraying a wet foam over the rock pieces as they are fed to the impactor. The chemical mixture (the combined CDS-80 foaming agent and water) is pumped from the semi-trailer through a pipeline, to an in-line accumulator (where the mixture is transformed into a foam) and finally to the spray-manifold. The water that is combined with the foaming agent in the semi-trailer comes, by pipeline, from a nearby 4000-gal. capacity semi-tanker.

Air regulated at 40 to 50 psi is delivered through an airline from the compressor to the accumulator where it breaks up the chemical mixture, thus creating the foam.

The center of this dust-control concept is the use of moist foam instead of water droplets. As seen later, the foam method requires far less water to control the same quantity of dust.

A similar spray system to the one just described supplies foam to two spray-nozzles located inside the impactor for wetting down the rock as it is being fragmented. The grizzly and inside the impactor are the only two foam-applications points required to control dust at the primary plant.

Dust control measures taken during the production process carry through all the way to load out.

Secondary and tertiary plants

The secondary plant features a 60-ton surge bin, a 6 x 20 El-Jay screen with a skimmer and a Cedarapids 5064 HRSI horizontal rotor shaft impactor and a double-row crusher.

Lastly, there is the tertiary plant. From the secondary plant, a splitter conveys the materials to two more 6 x 20 El-Jay screens with skimmers. The materials culled by the screens are fed to a Cedarapids tertiary crusher and recycled through the screens.

The through-products include: one-inch road base materials, 3/4-in. aggregates for concrete and asphalt mixes, 1/4-in. chips and minus-1/4-in. stone. The aggregates for the concrete and asphalt mixes are washed. However, with a crusher and impactor operating, also the three screens, the transfer conveyors and stackers operating, there is plenty of activity for creating airborne dust. This is particularly so when the rock being processed is limestone as it is at the present site.

A spray-nozzle arrangement similar to the one found on the primary impactor is installed on the secondary plant's impactor. There also is a bank of spray-nozzles installed at the tertiary crusher. No additional spray-nozzles are required at the transfer points nor at the screens. The foam sprayed on the materials in process at the impactors and crusher also controls the dust satisfactorily while the same materials are being conveyed and screened.

The plant design and its dust-control system were well thought out. Bill Gahan, Martin Marietta's general manager for the Kansas district says he and his people spent more than two years designing it.

"We (Martin Marietta) do not often buy new portable aggregates plants so we made sure this one was exactly what we wanted," Gahan says. "The plant will be used throughout the Midwest so the dust-control system had to be the best we could get. The reason is, some Midwest states have very strict fugitive dust laws, so the dust-control performance had to comply with them all. We considered a high-pressure water-spray system because it would be less costly but it will not control the dust as well as the foam-type system we bought. You get what you pay for."

Cost effective

The cost of the foaming agent is about 2-1/2 cents per ton of processed materials. This is based on applying 0.5 gallons of chemical mixture (as a foam) per ton of processed materials. About 4,000 gallons of the chemical mixture is applied over an 11-hour production day.

Bolyard is satisfied with the dust-control results attained with the new system. "We have been operating the new plant with the dust-control system for almost a year and it has passed every fugitive-dust-control inspection made by the Kansas Department of Health & Environment," he says. "The dust-control system consistently holds airborne dust levels below the State's maximum allowable quantities."

According to Bolyard, there are other benefits associated with the new dust-control system if compared to using plain water in a low-pressure spray system. A significant benefit is the drastic reduction in water quantities needed to control the dust.

With plain water used through the typical low-

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Foaming agent is stored in 2,000-gal. polypropylene tanks anchored to the floor in the trailer's end section.

pressure spray system, Bolyard says it would require 20,000 to 40,000 gallons of water per day instead of 4,000 gallons. At some sites the water must be purchased. But there is more.

First there are the pumping costs associated with it. More important, there are intermittent plant shutdowns and labor costs incurred for cleaning the screens that become clogged with overly moist fines.

"We had a water-spray system on our old portable plant," Bolyard says. "The plant processed only 300 tons of rock per hour, but every day we still had to clean the screens of caked fines. Partially clogged screens not only slow production, they lower the gradation uniformity of the materials, which is not acceptable to our customers.

"Every day it took four men 20 minutes to clean the screens," Bolyard says. "On top of that, 40 percent of the dust created from the plant still went airborne. If a larger but similar water-spray system were used at the new plant, spray manifolds would have to be installed at every transfer point, not just at the crushers. I do not know how often the screens would require cleaning because of wet fines caking on them, but it would be a significant problem."

Today portable plants are designed for two different applications. They are, for processing aggregates and recycling construction materials. Many newly designed plants are compact and simple to make road-ready. For example, some building materials recycling plants can be prepped for transportation in two hours. It follows that the dust-control system should also require little time and effort to move it from project to project. This new system also fills those requirements. PQ