Proper sampling is critical to all quality control.

An experienced loader operator ensures consistent, accurate stockpile samples.

Automated belt cut samples eliminate the human safety factor.

Two schools of thought include stockpile sampling and conveyor belt sampling.
Sampling for Quality

What you have to recognize is that sampling is critical to a plant’s quality control. “It’s just as important as testing,” says Tim Tipton, quality control director for Hinkle Contracting, a Summit Materials company. Tipton explains that production quality control has evolved over the years. Not only are producers more in control of testing their product quality than in the past, when the DOT agencies held all control, but the systems and methods for managing quality at aggregate facilities also have become more sophisticated.

The first step in testing material for quality is taking a sample of a product that will provide a true picture of the product’s gradation for a customer’s needs. Tipton says valid concerns for the final product also include contamination and segregation, which can occur on conveyors and in stockpiles—at both of which provide methods for sampling. Of course, there are pros and cons for each method.

According to Tipton, Hinkle prefers to use the stockpile sampling method, acquiring the sample with a loader, which is safer than using a shovel and bucket to pull samples directly from the pile. “The loader operator takes material from three to five locations in the stockpile, loading at a right angle to the flow of how the stockpile was built,” he says. These samples are used to create a “mini” stockpile from which another sample is taken for testing. The method helps to address concerns of contamination and segregation, as long as an experienced operator is taking the sample.

Conveyor belt cuts are another way to sample aggregate materials, and can be accurate for determining gradation. The traditional method for obtaining a belt cut sample requires the plant to stop production. A template that matches the curvature of the conveyor belt is used to manually cut and separate a cross section of the material. The worker takes three to five cuts, brushing the material into a bucket for testing. “This type of testing doesn’t give you the full picture of your material. It relies on the employee taking a complete sample, including fines, and it also creates safety concerns,” Tipton says. Adam Orner, global product manager for wet and dry sampling at McLanahan Corp., agrees that the traditional belt cut method has its limitations and concerns. “This is why we promote the use of cross belt samplers,” Orner says. Cross belt samplers are automated, enclosed machines mounted on the conveyor. They use a “bucket” with a counterweight to swing and scoop samples from the moving conveyor, delivering them to a container. “With cross belt samplers, you have no downtime, and it eliminates safety concerns,” he says.

Conveyor belt cuts and falling stream samples provide a good picture of the products being made, especially addressing concerns with gradation. Belt cuts require shutting off the belt and taking samples from three to five locations, using a template to cut out the samples. Manual sampling from the material flow falling from the head pulley leads to safety concerns. The belt cut method affects both production and safety.

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For the best consistency in sampling, it is ideal to have the same experienced loader operator take all samples for a particular product. This eliminates issues that can arise from variables in technique. Ideally, the loader operator should obtain material from three to five locations in the stockpile, load at a right angle to the flow from which the stockpile was built, and then create a miniature stockpile.

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Automatic cross belt or falling stream sampling can eliminate concerns with safety and consistency. In the simplest terms, the cross belt sampler operates inside an enclosure, with a counterweight and swinging cutter bucket that scoops material from the belt under production, emptying it into a sample container. A falling stream sampler automatically crosses the stream from the head pulley to obtain the sample from the flow.

It is best to install a cut zone idler and cushion system beneath the conveyor as part of the cross belt sampler. The cut zone system forces the conveyor belt into the proper radius conformation to obtain a full cut from the belt—including fine material. The cutter bucket must be large enough to obtain a full cross section of material and should swing at a speed slightly higher than the speed of the conveyor.
**Tim Tipton**

“Proper sampling is critical to successful quality control,” says Tim Tipton, quality control director for Paris, Ky.-based Hinkle Contracting. “You must be uniformly consistent in how and when and where you pull your samples.”

Hinkle Contracting takes material sampling seriously. The company has a sampling qualification program for its own production foremen and employees, as well as for DOT personnel.

“We prefer to sample from stockpiles,” Tipton says. “If you build your stockpiles right, we feel this method best addresses concerns with gradation, contamination, and segregation. A loader and an operator experienced in sampling will get you a very accurate picture of what is going out the gate to your customers.”

Accuracy of the sample starts with stockpiling practices, Tipton explains. Variables in how a stockpile is built can affect its quality. “Do you stockpile by truck? Do you use a fixed or radial stacker? A Superstacker (telescoping stacker)?” he asks.

Stockpiles built by truck grow in layers, keeping the material from cascading down the slope of the stockpile — reducing segregation. A radial stacker that moves back and forth also builds stockpiles in layers. In building a stockpile with a conventional fixed stacker, the key is to keep the stacker as low to the pile as possible. “If you let the material fall from 50 feet in the air, you are going to have segregation in your stockpile,” Tipton says. “I like the Superstacker style,” he adds. They’re both telescopic and radial, building the pile in windrows, for the best shot at eliminating segregation.

In obtaining the samples, Tipton recommends pulling three to five samples from the pile to create a miniature stockpile. “You want to get the bucket into the stockpile as deep as you can at a right angle,” he says.

Of course the greatest piece of advice Tipton has is to be consistent with the sampling time, method, and operator. “Training is important, and you have to figure out which method is best and do it the same way every day,” he notes. “It also helps to make sure your operators — and all employees — understand what the customer needs, what their applications are, and the importance of producing quality products.

“Always try to keep everyone in the loop, so someone isn’t trying to do it by himself. Quality control is a journey, not a destination,” Tipton concludes.

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**Adam Orner**

Today’s methods for sampling aggregates can vary greatly. They include traditional methods such as taking shovels-full of material by hand or loader from a stockpile, manually holding a container under a conveyor head pulley, and obtaining conveyor belt cuts by hand. They also include more automated methods such as cross belt samplers.

“We try to steer people away from manual sampling, particularly from stockpiles. We believe that the best methods remove human interaction — for safety and consistency,” says Adam Orner, global product manager for wet and dry sampling at McLanahan Corp., based in Hollidaysburg, Pa. “If you have a person taking discretionary samples from a stockpile, you may not be getting the best samples. If you’re taking traditional hand samples or stopped belt cuts, you are dealing not only with potential safety issues, but also with costly down time and labor associated with manual material handling.”

A cross belt sampler collects a full cross section of material from a moving belt without human interaction. The operator can take samples with the push of a button or automatically set the sampler to take samples at certain times of a shift.

“Cross belt samplers are cost-effective, easy to install, and collect manageable sample increments,” Orner says.

The cross belt sampler is a fully enclosed machine, which contains a rotating, counterweighted cutter assembly. The cutter assembly rotates through a full 360-degree rotation to cut a material sample from the moving conveyor belt before decelerating to a stop back at its original parked position. The key to obtaining a complete and representative cut is to also install a Cut Zone multi segment idler and impact cradle system beneath the conveyor as part of the cross belt sampler. The Cut Zone system forces the conveyor belt to conform into the proper radius to obtain a full cut from the belt — including fine material.

“With the cross belt sampler, you want to make sure that the cutter bucket capacity is larger than the cross section of material on the conveyor belt,” Orner explains. “The cutter opening varies based on your product size. We recommend a bucket width of three times greater than your top size material. A consistent cutter speed is also important; the cutter should not slow down as it travels through the material flow. A good rule of thumb is a cutter speed greater than one-and-a-half times the belt speed to help assure a quality cut and minimize spillage,” he says. The time interval between cuts really depends on the producer’s sampling plan.