If you’re planning to hire an engineering firm to help modify your plant or build an addition, you can take several steps to ensure the project goes smoothly. The first three sections in this article describe how to work with an engineering firm. The final section is a case study that shows how a foundry worked with one such firm to solve a large-scale handling problem.

Analyzing your problem

You can’t find the right solution to your handling or processing problem without carefully identifying the problem. Is your process bottlenecking at the packaging stage? Do you need to expand your production line to meet increasing customer demand? Are air quality requirements driving a change in how your plant handles dust? Do you need to find a more cost-effective way to move materials in and out of the plant? Do you want to better control particle size or product quality, reduce landfilling costs, increase processing speed, or cut labor requirements?

Regardless of your problem’s nature, consider what plant or equipment changes the solution is likely to require, as well as your budget, your deadline for implementing a solution, and what services you will need from engineering firms. They can provide any or all of these services: designing and engineering a whole plant or a handling or processing system, selecting and testing equipment, constructing a plant or addition and installing equipment, and supervising startup. If your plant is faced with upgrading a handling or processing operation, an engineering firm’s resources and expertise can be important to your project’s success.

But to work successfully with the firm will require good planning and communication at every stage. A typical engineering project includes these major stages: analyzing your problem; hiring an engineering firm; and working together during design and planning, construction and installation, and startup.

Modifying a foundry’s material handling system to recycle 350 tons of sand and dust per day

Engineering project:

The mixing facility houses a mixer, related components, and silos for storing the foundry’s spent molding sand and dust. The filter receiver, shown here during the facility’s construction, separates dust from the conveying air.
an engineering firm. Depending on your plant’s experience with similar problems, you may have a good idea of how to solve the problem before you contact an engineering firm or you may need to contact the firm at the outset for advice about potential solutions.

**Hiring an engineering firm**

Engineering firms specialize in various services and industries. Choosing one typically depends on how many services you need, your industry, and your location. It helps to work with firms who have experience with your industry and the equipment you use. Get a list of similar projects they’ve completed to make sure their expertise matches your needs. And if you’ve had success working with a particular engineering firm in the past, it can simplify the job to work with them again.

In any case, solicit bids from more than one engineering firm and supply each firm with identical information on the project’s goals, scope, deadline, and other details. That way, you can ensure the submitted bids cover the same items.

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A 20-foot-high roof addition increased the mixing facility’s height to accommodate new equipment. Here a crane begins to raise a 2,000-cubic-foot sand storage silo onto a support structure in the facility.
Working together
After you've chosen the engineering firm, you need to work together closely to ensure the project meets your goals, deadline, and budget. Because an engineering project can take several months or even years to complete, it's important to lay a solid foundation for your partnership at the start.

Good communication between the right people at the right times is the real key to completing the project smoothly. Naming one representative at the firm and one at your plant to be primary contacts and setting up a regular schedule of face-to-face or telephone meetings are good ways to accomplish this.

Design and planning. During the project's design and planning stage, be ready to provide detailed information about your plant goals and the existing handling or processing problem, your material's characteristics, equipment options, and other details. This will give the engineering firm a clear understanding of what you expect the project to achieve and whether the solution you have in mind is feasible.

As the firm prepares detailed plans and specifications for the project, expect to work together to discuss space requirements, equipment layouts, and other details. Depending on your needs, the firm can also help you select and test equipment. Careful attention to details in the plan will help you spot and solve any problems that could be much more costly and time-consuming to fix later.

Construction and installation. If your project requires major construction, it's important to plan well ahead of time so all materials and equipment arrive at the site before or just as construction starts. Construction and equipment installation typically occur during plant downtime — such as weekends and holidays — to avoid halting production. The engineering firm can help determine how much time will be needed for these steps as well as make sure all materials are ordered on time. The firm can also supply workers and coordinate the work of various subcontractors during construction and installation.

Startup. When the new equipment is started up, the engineering firm's representative should be present. The representative can help you troubleshoot any problems and fine-tune the equipment's operation to meet your goals.

In the following example, you can see how a plant worked successfully with an engineering firm specializing in design and construction to make a major plant modification.

Case study
Indianapolis Casting Corp. (ICC), a business of Navistar International, is a foundry in Indianapolis that sand-casts heads and blocks for 1,500 diesel engines per day. And every day, the foundry generates not only 300 tons of spent molding sand but another 50 tons of dust. Up until 1996, the foundry landfilled all of this waste material.

But the labor and cost of landfilled were minor problems compared with the challenge of containing the collected dust as the material was moved around the plant. "We did a great job with dry bag dust collectors — capturing dust from various machines, operations, and processes throughout the plant. But once we collected the dust, we didn't have the best process for handling it and loading it for disposal," says Tom Cody, ICC's facilities engineering manager. Ten baghouses are located at various points in the 10-acre foundry.

Some of the collected dust was bagged and carried to trucks by forklift. Inevitably, some bags were damaged and dust spilled in the plant. "Even a small fraction can be a big nuisance when you're handling up to 50 tons of dust a day," says Cody.

A more troublesome problem was preventing dust from being released into the atmosphere — both when the dust was discharged from the bags into ICC's outdoor waste storage pit and later when the dust was loaded from the pit into trucks for hauling to the landfill.

Good communication between the right people at the right times is the real key to completing the project smoothly.
“We’d mix some dust with spent sand in a water bath [a water-filled moat surrounding the waste storage pit] to try to prevent fugitive release, but the dust is extremely difficult to wet,” says Cody. “Often our overhead crane would pick up a clamshell bucket-load of wet dust and sand out of the water bath and dump it into a disposal truck, only to have a huge dust cloud roll out. The dust and sand from the water bath were only wet on the surface.” And from an environmental standpoint, the fugitive dust was a much bigger problem than the spent sand.

Despite the project’s large scale, the foundry was able to achieve everything they wanted and more by carefully selecting equipment and working closely with the design-construction firm.

Analyzing the problem. In spring 1995, the foundry began to look for a way to contain the enormous amount of dust generated each day. They needed a large-volume system that could not only handle the 350 tons of spent molding sand and dust produced daily but could keep the dust from escaping. And they wanted to recycle the waste materials into a usable product to avoid landfill costs and increase revenues.

Creating a system concept and selecting equipment. The foundry came up with a concept for an automated handling and mixing system that would pneumatically convey the sand and dust to a mixer. The mixer would blend the materials with water to contain the dust.

The new system would also produce a material-and-water mixture that could be used to create marketable products with a stable, usable consistency. ICC saw many potential applications for the products, including road fill and asphalt, cement, and concrete production. What’s more, the handling and mixing system would eliminate the labor required for moving sand and dust around the plant and the cost of hauling the materials to a landfill.

Finding the right mixer was the first step. The search took several months, much longer than selecting any other equipment for the project. “Just about any [mixer] could handle the sand, we felt, but the dust is pretty tricky,” Cody says. “It can vary from extremely fine, like talcum powder, to extremely coarse. It doesn’t absorb water easily or uniformly. The big challenge was finding one piece of equipment that could effectively handle two very different materials — spent molding sand, which is homogeneous and has some moisture in it, and dust, which can vary in particle size and is extremely dry.”

The mixer was critical to the system for two reasons:

- The mixer’s controls would have to meter water into the mixer vessel in just the right proportions to blend the water with straight sand, straight dust, or a combination of both materials.
- The unit would have to precisely control the mixing process in response to each customer’s order so the final product had the consistency of garden soil.

After an extensive search and visiting many foundries with similar handling and mixing systems, the foundry selected a mixer supplier. The supplier’s mixer would be part of a mixing facility that would form the heart of the new system.

Hiring an engineering firm. The foundry contacted several bidders to provide the detailed design and construction services they required to get the new mixing facility up and running. They awarded the contract to Kirk & Blum-Indianapolis, the local office of a regional firm that specializes in engineering, fabricating, and installing systems for dust and fume control and process ventilation. With six offices located throughout the US industrial belt, this design-construction firm had the experience with automotive plants and foundries that ICC was looking for.

Designing the system. After consulting the mixer supplier and the design-construction firm, the foundry determined that the mixing facility could be constructed in an existing but unused building at the foundry. It would include silos to store the sand and dust, a dust filter receiver, a weigh hopper, various mechanical conveyors, a mixer, and a truck-loading bay. ICC worked closely with the design-construction firm to refine the system design.

Once all the equipment and related components were selected and the
project design was completed, construction and installation began. [Editor’s note: Equipment suppliers for this project are listed in the boxed section, “Who supplied equipment,” above.]

**Constructing and installing the system.** The design-construction firm installed the pneumatic conveyors over several weeks, tying them into the existing plant equipment in phases during regular plant shutdowns. A dilute-phase pneumatic conveyor for dust was installed with feedpoints at the foundry’s 10 baghouses. A dense-phase conveyor for sand had feedpoints at two spent-molding-sand collection bins in the foundry.

The design-construction firm constructed the mixing facility over a 3-day plant shutdown on Labor Day weekend in 1996. The facility is shown in Figure 1 (some equipment and components aren’t pictured).

First, the firm installed the mixing equipment, including the weigh hopper below the silos, the mixer, various mechanical conveyors, the truck-loading bay below the mixer, and a mixer control panel, which was also located in the loading bay.

Next, workers used a crane to install five 2,000-cubic-foot silos for storing sand and one 1,700-cubic-foot silo for storing dust. The silos were lifted 90 feet and then lowered through the mixing facility’s roof. A filter receiver was mounted above the dust silo in the same way.

The final step in constructing the facility was to raise the existing building’s roof by 20 feet. This gave the building the height it needed to accommodate the new equipment. Workers used the crane to lift prefabricated structural members for the extended walls and roof into place atop the mixing facility.

**Startup.** ICC and the design-construction firm observed the system startup after a holiday shutdown in late December 1996. They were pleased to see that the automated handling and mixing system operated as intended and created a consistent product.

In operation, the pneumatic conveyors transfer the 300 tons of spent molding sand and 50 tons of dust from the foundry into the mixing facility silos each day. The sand discharges directly into the sand storage
processing the mixture until it's homogeneous. The mixer unloads the final product into the waiting truck. The entire ordering, mixing, and truck-loading sequence takes 15 to 20 minutes per truck.

Results. Despite the project’s large scale, the foundry was able to achieve everything they wanted and more by carefully selecting equipment and working closely with the design-construction firm. After several months of planning, they quickly completed construction and installation during normal plant shutdowns.

The automated system not only solves the foundry’s fugitive dust problems but mixes the sand and dust into usable products. In fact, says Cody, “now that we’re able to deliver a predictable, homogeneous material, we’ve found lots of businesses that are interested in it for something other than roadfill. We knew there was this potential when we put together the project, but possible users didn’t want to commit until they saw what the material was like.”

As a result, ICC no longer landfills the materials, which saves labor, trucking, and landfill costs. “We’ve created a highly automated system for sand and dust removal, provided comprehensive safeguards against accidental or fugitive release, and turned landfill into a recyclable commercial product.”

—Tim Schneider,
vice president,
Kirk & Blum-Indianapolis,
Indianapolis;
317/244-3383
(fax 317/243-1244).

Want to share the details of your engineering project?
Fax your idea to:
Sherri Weiss
Editor
Powder and Bulk Engineering
612/866-1939 (fax)