Beyond the White Glove Test

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Growing consumer demand for a greater variety of high quality products requires that food processing facilities increase production and improve efficiency at every step, and the cleanliness of production systems is an important component to any food processing facility. What’s often overlooked, however, is that increased production can strain the systems responsible for keeping a facility clean, which compounds the already arduous task of ensuring that production machinery is clean.

Efficient dust collection systems at the measurement and mixing step and easy-to-clean production equipment at the sizing and agglomeration step are important factors to address to make sure production doesn’t outpace the cleaning system and that the operability of the cleaning system doesn’t slow down production. Carefully designed upgrades to the cleaning systems and the production equipment can be technically sound, cost-effective, reduce downtime, and minimize capital cost. Here’s how.

Dust Risks and System Design Problems

The measuring and mixing step of dry processing is a notorious dust generator and facility owners recognize that dust is a health and safety issue. Preventing slips and falls, inhalation, as well as environmental and food contamination are normal concerns. The potentially fatal effects from combustible dust are of primary concern in a variety of industries.
Although OSHA’s 2007 Combustible Dust National Emphasis Program and the

National Fire Protection Association provide standards that should be followed, combustible dust explosions continue to occur and sometimes with fatal outcomes; therefore, OSHA is redeveloping stricter guidelines to address explosion hazards from combustible dust.

All too often, dust collection systems are poorly designed to meet the urgent needs of increased production. Quick fixes lead to improper duct sizing, inconsistent velocity, and often additional technical problems.

For example, inconsistent velocity over the course of a run of ductwork — in particular, high velocity at the beginning of the run and low velocity at the end of the run before filtration — may cause heavier dust particles to settle out and accumulate in the system, increasing the risk of the combustible dust explosions the system is intended to prevent.

Similarly, inadequate deflagration venting or suppression systems also increase the risk of explosion, as does failure to address details such as bonding across gaskets to prevent static build-up.

Design inadequacies can also create logistical problems, for example, when routing of new ductwork collides with structural components such as building columns, or poor placement of new hoods creates obstructions that personnel must work around.

The optimal, cost-effective solution is one that avoids unnecessary replacement of an existing system which requires higher capital costs and longer downtime. Food processing facility owners should instead consider a system upgrade designed by an experienced process engineer whose work ethic is a teamwork-based, holistic approach.

Analyze the Whole System, Not Just the Parts

In order to take a holistic approach to analyzing systems and processes, extensive information must be collected. Direct observation of the process, as well as discussions with the team will surface many pertinent pieces to the puzzle, from site-specific issues and operator challenges, to the temperature and humidity of the interior environment, to the specifications of the product being processed.

Often overlooked are key operations personnel who always have valuable insights about their day-to-day challenges with minimizing dust. Their ideas and approaches to mitigate the dust problem should be thoroughly noted. Direct observation of the process by the engineering team also yields many clues that are not conveyed through the original as-built drawings.

Plan for Increased Production

Carefully designed upgrades to existing dust collection systems are often good technical solutions to increase production and improve efficiency; they are cost-effective, too.

In the case of a processed breakfast food owner, an increased volume of dust was generated as operators added major ingredients like flour to the mixers and put hand-weighed minor ingredients like baking powder into a bag-dump station. Not only was the increasing amount of dust in the working atmosphere creating a health risk to employees and an explosion hazard, but it also became a serious housekeeping issue.

After careful evaluation, it was deemed that just a few modifications, in lieu of a system replacement, would cost-effectively do the trick. Upgrading the current motor to one with more horsepower increased the fan speed to optimal levels without having to replace the existing filter. But while the filter's air-to-cloth ratio remained suitable, a section of ductwork was replaced to accommodate the increased flow.

A little trickier was determining the location of pick-up points and hoods to assure proper coverage without interfering with operations. Proper placement in this case was one hood positioned at the back of the mixing table, another hood at the bag dump station, and a pick-up point was connected to the mixer itself.

One challenging aspect of the design was routing the new ductwork to avoid building columns, pipes, conduit, and production equipment, but 3D modeling expedited the location of optimal routes. Another challenge was strategically locating the dust filter to prevent explosions from build-up. An outdoor filter would not do because of exposure to humidity and condensation, so it was determined that the best solution was to locate it in a room that was vented to the outdoors.

Only a holistic assessment of the issues and challenges surfaced the right solutions and served as the foundation to a solid design — from the characteristics of the product, to the process of ingredient measuring and mixing, to the interior environment and structure.

Another major processed food owner faced a similar dust collection challenge when it added a new snack product to its brand line that called for a significantly higher amount of dry ingredients. The owner's initial hope was to tie new pick-up points at two mixers and tie existing ductwork to a bag-dump station, but the existing 60,000 cfm air filtration system was already operating close to capacity to support the increase to dry-processing. The system was upgraded with a new fan and filter to provide for proper air flow and pressure drop, as well as installation of additional pick-up points. To meet the new filter's air-to-cloth ratio and function properly with the new pick up points, several sections of ductwork were replaced.

In both examples above, carefully designed upgrades to existing dust collection systems were technically sound, cost-effective, and minimized downtime.

Hinges & Clamps

Another literal sticking point in dry processing occurs at the sizing and agglomeration step due to equipment that is difficult and time-consuming to clean.

Consider a size-reduction step with a mill or grinder that spouts to a conveyor, which goes to a sifter where fines and overs are removed and conveyors take them back to the system or to waste.

Say this system is bolted up and is a nice tight system that works well. However, operators can't get into it to clean the many corners and crevices without back-taxing tools that are required to unbolt myriad parts and pieces. Disassembly, cleaning and reassembly take far longer than they need to, increasing downtime.

In contrast, consider an effective design that streamlines this system, limiting transition points to reduce or eliminate unnecessary spouting and conveyors. Equipment is selected with accessibility in mind, reducing or eliminating bolted connections that require tools to disassemble and reassemble.

Since it is difficult to modify equipment installed years or decades ago, replacement is necessary. While equipment vendors have recognized that hinges and clamps offer easier accessibility, proper specification parameters developed by qualified engineers prior to purchasing is a must. The additional step of a thorough vendor submittal review will ensure the equipment meets the facility's requirements and expectations of equipment accessibility.

As in all good process engineering, the best solutions in these two areas are developed through teamwork among facility owners, internal and consulting process engineers, and key operation personnel. Designing cost-effective dust collection systems and easy-to-clean production equipment isn't just about passing the white glove test. These systems are critically important to safeguarding workers, promoting food quality, and improving process efficiency.

For more information, please visit www.ssoe.com *[1].*

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