

ASSESSING THE CONDITION OF YOUR STORAGE SILO

Storage silos might not be top of mind in your operation, but they're certainly a crucial piece to any successful bulk solids process that shouldn't be forgotten. This article describes the importance of regularly inspecting your silos as well as what to look for during these inspections.

Mandy Landwehr, Imperial Industries

How often do you really notice your storage silos? If you work in operations and are present during filling or cycling, you might think about them every day. If you work in maintenance, you might think about your silos when there's a problem or when working near them. Or, if you don't work directly with your storage silos or see them every day, maybe they rarely cross your mind. Perhaps, they've been in place at your facility for so long that they blend into the industrial landscape as an important but sometimes forgotten element of your operation. Forgotten, that is, until something happens to remind you of how critically important safe and efficient bulk storage truly is to your business. As businesses are highly customized and bulk storage needs are unique to the material being stored, each facility must assess what their bulk storage conditions are on a case-by-case basis.

Preparing for inspection

The best way to keep the phrase "out of sight, out of mind" from applying to your storage silos is by adhering to a regular silo inspection and maintenance schedule. Plan to critically look at each silo at least annually. Create some urgency regarding the matter to ensure follow-through. Imagine what would happen if your silo suddenly disappeared overnight. What sort of disruption would that cause for your business? If you were suddenly unable to store or move material, how big of a problem would you have? How much would silo downtime truly cost you? Set up time for a qualified person from within your facility to look at your silos from all angles and elevations. A simple visual inspection can uncover problems that might need further investigation. Create a checklist to document each part of the silo. You will want to take photos of what you see, both close up and from a distance. Photograph any nameplates or equipment tags and record that information.

Inspecting the exterior

Foundation. Begin with inspecting the foundation. Are there cracks or *pitting* present in the concrete? Pitting is when small holes or "pits" develop on a concrete surface. These imperfections can be due to moisture migration, a lack of silo reinforcement, or increased material loads within the silo, among other reasons. In terms of drainage, does water drain away from the silo or pool in place? If water pools in place near the silo base or columns, this can promote corrosion. If you don't see any water, look for low spots or depressions in the concrete.

Connection points. Inspect the bottom-most connection points and any hardware for corrosion. Take pictures of any corrosion that you see. There should be continuous grout underneath the silo base ring if you have a skirted silo or under the baseplates if there are columns present. Look for pitting corrosion above the base ring on skirted silos and, if present, take some photos with a tape measure in the picture to record the pit's size. Does the pit go all the way through the base metal? If so, document the pit location and size. If your silo is secured by embedded anchor bolts, what is the bolts' current condition? If there are clamp or hold-down plates, are they rusty?

Body. Next, move onto the silo's body. Some silo bodies are covered with a coating or paint system, which is comprised of different types and layers of paint or other coating materials applied in a certain sequence. How does the paint or coating material look? Is the coating's texture smooth and shiny or chalky? Is there surface rust present? Ideally, you want to see a smooth, uninterrupted coating of uniform color along the entire silo surface.

Look at the silo's sidewalls. Are there any dents or deformations present? If so, where and what size are they? Dent or deformation depths are measured by laying a straight-edge flush vertically with the silo wall and then measuring the distance from the straight-

edge to the dent's center. A general length-by-width measurement should be taken as well. If there is a dent present in the silo, do you know what caused it or when it occurred? Dents can originate externally from something impacting the silo or internally due to vacuum pressure from flow-related issues. Are there penetrations in the skirt for piping or wiring? Are those penetrations sealed completely against water?

While insulation is used in many industries to help limit condensation, mold, and spoilage, insulated silos create challenges for inspection, as one side of the silo wall is typically hidden from view. If your silo has high-density spray foam, mineral wool, or fiberglass insulation, look for unsealed areas that might have let water in behind the insulation, as pockets of corrosion can occur in locations where water can become trapped.

If there's a ladder system on your silo, what style is it? Does the ladder have a full cage or is it equipped with a safety-climb cable system, as shown in Figure 1? Look at the connection points between the ladder and the silo, checking for cracks or corrosion. If your silo has columns and cross-bracing, are there any sections missing? Oftentimes, installers will remove bracing to accommodate equipment and sometimes forget to reinstall the bracing. Make note of any columns and cross-bracing that are seemingly absent or damaged.

Roof. Inspect the silo roof. If there is nonskid coating or self-adhesive nonskid strips present, are they intact and functional? Are any present guardrails sturdy? Do all pressure-relieving devices operate as designed? Is there stored material present on the silo's roof? Often, there are pressure-relieving devices or

passageways for tank entry located on the silo's roof. Stored or previously stored material sitting on the roof is indicative of a spill or leak. If there is material present on the silo's roof, can you tell where the material is coming from?

Connection points. You should familiarize yourself with how your storage system operates in relation to the equipment that interacts with the silo. Are the pneumatic conveying system fill lines, tubes, and elbows intact and in good working condition? Are the baghouses or dust collectors connected to the silo clean and functional? If there are gaskets present, do they need replacing?

Inspecting the interior

Body and roof. Examining an empty silo is also necessary for proper service and maintenance. With the silo empty, note the interior condition. If there are coatings on the interior, do the coatings appear to be intact? Are any areas of the coating peeling or are bare spots present? Check the top few feet of coating below the roof, as condensation will accumulate there and can sometimes cause coating damage. Signs of coating damage include paint or coating that is peeling, bubbling, flaking, cracking, checking, fading, or corroded.

Compiling your information

Once you have your findings, put them in a reference file. Include dated photos of the full inspection. Document everything you know about the silo and make a list of the things you aren't sure about, so that you can reach out to the appropriate parties and request more information. Perhaps, you have the silo's original construction drawings. These are valuable, as they tell you important facts about the silo such as what material and material density the silo is designed to hold.

Assessing variables

Material change. If the material you're storing has changed in type or density over time, or the conveying system connected to the silo has changed in pressure or velocity, you may find that your silo isn't actually usable at maximum capacity. For example, if your original silo design was to store a pelleted material but the current conveying process causes the material to break down, this would ultimately lead to a denser material for storage. Knowing your current material's bulk density and understanding what the silo was originally designed for are both important factors to understanding if your silo is the proper storage for your material.

Silo design. Original construction drawings might also show the coating system, if there is one, as well as verify the original sidewall, roof, and hopper thick-

FIGURE 1

Silo ladder systems exist to keep personnel safe when inspecting a silo but these ladder systems need to be inspected as well.



ness measurements. You might come across company names involved in the original design of the silo or processing equipment. Research those names to find out if they are still in business as you'll want to know whom to contact should your silo need maintenance or replacing. Better to find out ahead of time that your silo's manufacturer is no longer in business when you don't need their help than when your silo requires immediate repair or replacement.

Silo age. No matter the age of the silo, if you don't know much about it and weren't with the company when the silo was erected, seek out those employees who might know more. There might be individuals within your organization who remember the silos' arrival or other details about them. Discuss with these people everything they can recall about the silos and document this information. As people move towards other jobs or retirement, knowledge can be lost with them. Gather all of the information you can, and then assess what you have.

If your silo is relatively new and appears to be in great shape, tuck your file away or save electronically in a place that at least one other person in your organization knows about and schedule next year's in-house inspection. Should something unexpected happen, you'll want all of the individual silo information in one handy place for immediate reference.

Analyzing concerns

Should your silo inspection turn up some trouble spots, analyze the concerns. Are they maintenance items that can be accomplished in-house, like cleaning, sealing, or spot painting, or do you need input from an outside contractor? Structural concerns such as dents, pitting, or base metal thinning require professional inspection, including examinations like ultrasonic thickness testing for base metal or dry film thickness testing for coatings. Internal confined-space repairs require specialized equipment and training. Schedule and make repairs with the appropriate qualified professionals, updating your silo information file as you go.

Once your silo is refurbished, you're responsible for keeping it properly maintained, which should be easy if you adhere to your planned silo inspection and maintenance schedule.

Don't ignore your silos. Instead, subject your silos to regular inspection and maintenance. If you don't wish to take on a silo inspection yourself, there are reputable silo manufacturers who offer their own professional inspection services. These professionals would be happy to assess your silos and make recommendations for your unique storage needs. **PBE**

For further reading

Find more information on this topic in articles listed under "Storage" in *Powder and Bulk Engineering's* article index in the December 2019 issue or the article archive on *PBE's* website, www.powderbulk.com.

Mandy Landwehr (mandy@imperialind.com, 715-359-0200) is the quality control-quality assurance manager and customer service and claims manager at Imperial Industries. The company is made up of multiple divisions, one of which is the ITS division, which offers tank inspection, cleaning, installation, and repair services.

Imperial Industries
Rothschild, WI
715-359-0200
www.imperialind.com