

Case history

Bolts beat welds in erection time and labor

A precipitated calcium carbonate producer switches from welded to bolted tanks.

Specialty Minerals, a subsidiary of Minerals Technology, is headquartered in Bethlehem, Pa. It produces precipitated calcium carbonate (PCC) at 42 satellite opera-

tions worldwide. PCC, a synthetic form of calcium carbonate, gives paper brightness as well as opacity and can replace wood pulp or more expensive mineral fillers. Specialty



Precipitated calcium carbonate is stored for use by an adjacent paper mill.

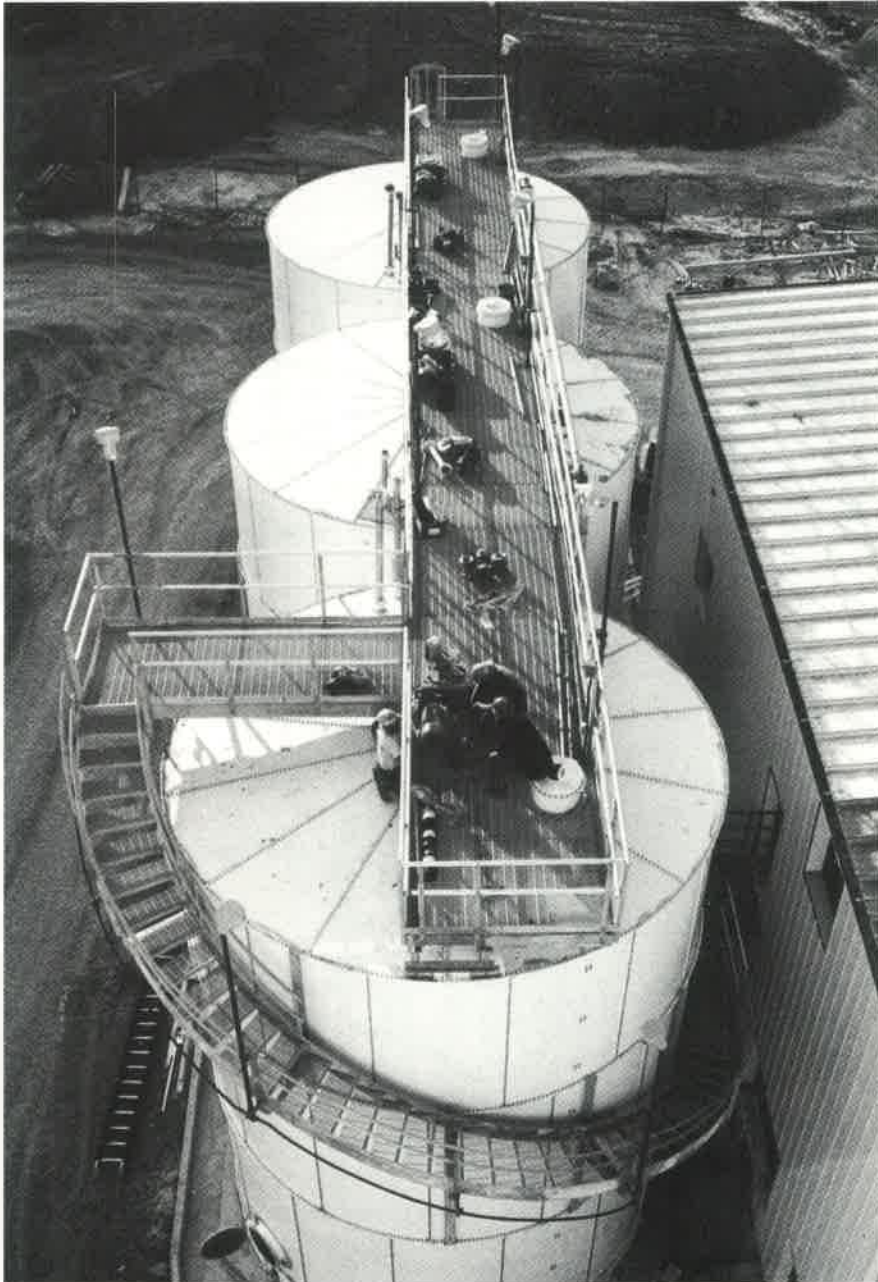
Minerals uses bolted silos for raw lime storage and bolted tanks for PCC storage.

In the mid-1980s, the mineral producer found the best way to supply PCC to the paper industry was to set up satellite plants adjacent to the paper mills. This proximity gives mills ready access to precise, consis-

tent amounts of PCC and reduces costs for both parties.

A satellite plant has a symbiotic relationship with the mill it serves. Typically the plant receives water and electricity from the mill and pipes wastewater back to the mill for treatment. The plant also gets a raw material, carbon dioxide, from the mill.

At an average installation, bolted silos and welded tanks took 10 to 12 weeks to erect. Changing to bolted tanks has reduced this to 5 or 6 weeks.



These tanks were factory-coated and then bolted together on-site at one of Specialty Minerals' satellite plants.

"We use the waste gases that would otherwise be put up a boiler stack or kiln stack," said central engineering manager Lucky Yaple. And when the mill needs PCC, the plant pumps it directly to the mill in a water-based slurry.

For PCC production, calcium oxide powder, commonly called quick lime, is slaked with water to produce a milk of lime. The slake is added to a reactor along with some proprietary chemicals, and carbon dioxide is bubbled through it, causing calcium carbonate particles to precipitate. The PCC is then screened to remove impurities and stored in tanks at the plant. The plant keeps enough PCC on hand for about 3 days of paper-making.

A satellite plant can require up to 20 storage vessels for raw lime and finished PCC storage. In the past, Specialty Minerals shipped tanks to satellite locations in sections that were then welded together and coated on-site.

Various problems surround welded tank erection

As Specialty Minerals built more and more satellite plants in the 1980s, "the problems with welded tanks became apparent and increasingly troublesome," said design manager Neil Gallagher.

"There was the excessive lead time required to get them ready for use," he said. In the past, it averaged 10 to 12 weeks to erect and prepare all of the plant's storage vessels. The bolted silos used for lime storage required less time and effort to erect than the welded PCC storage tanks. Erecting tanks required field welding, sandblasting, instrumentation wiring, piping, exterior and interior coating, and inspection.

"One major reason it took 10 to 12 weeks was that the interior and exterior coatings couldn't be applied until

the tanks were welded together," Gallagher said. Without acceptable temperature and humidity, the paint coatings couldn't properly dry. "A four-coat system was developed for the exterior coating so painting alone took 4 to 5 weeks," Gallagher said. Yaple added, "We were at the mercy of the quality of painter available that day. We couldn't control that. And the coating would have to air-cure, so it wouldn't be as tough as a factory baked-on coating."

"I don't know how you quantify the benefit of working with the same supplier team each time, but it's a very important efficiency that flows straight to the bottom line."

Besides extensive lead time, erection labor costs concerned the PCC producer. "We knew if we could reduce the erection time, cost would drop," said contracts purchasing manager Steve Sheffield.

As Specialty Minerals established new satellite plants, drawings for welded vessels were contracted locally so a central designer wouldn't have to be sent to each new plant. But the learning curve for the local engineers was time-consuming and sometimes frustrating according to Gallagher. "It was like starting over in every city without the benefit of the experience from each previous installation." The result was inconsistency from plant to plant, which created inefficiencies and occasional quality control problems.

After welded tanks had been in service for a while, another problem began occurring. "PCC is stored ideally at about 130°F," Gallagher said. "We started seeing PCC react with the interior paint's pigment at this

temperature and become contaminated. PCC particles are very bright white. Any kind of rust or pigment contaminates it and dulls the brightness. Because PCC is used as a brightener, this became a critical problem."

Study points to factory-coated, bolted vessels

The PCC producer conducted a formal study to solve problems identified with the welded tanks. Research included tests on coatings, hardware, and gasketing, as well as erection time and ease.

"We were primarily comparing welded to bolted carbon steel tanks," said Yaple. "But we also considered a variety of coatings, and we looked at stainless steel tanks, which don't need coatings."

The producer found bolted carbon steel tanks could eliminate the major problems experienced with welded units. Bolted tanks could be shipped in sections, then quickly and easily bolted together without using skilled labor. The study showed that erection time at an average satellite plant would be about 4 weeks faster. The interior coating would be baked on at the tank manufacturer's factory, saving time and eliminating potential problems with PCC contamination. By contracting with only one vessel manufacturer, regardless of satellite location, the producer could eliminate consistency problems. The study also showed that bolted tanks could be erected at about one-half the cost of their welded counterparts.

After deciding to switch to bolted tanks, the producer considered several manufacturers but chose an existing supplier. "We had been buying their bolted silos for lime storage," said Yaple. "It was a natural decision to buy from them. Going with a bolted, factory-coated tank, no matter who made it, was an obvious choice. We had worked with them before and were comfortable with the material they use to coat the tanks."

Producer switches to factory-coated, bolted tanks

Specialty Minerals' new PCC tanks are carbon steel and factory-coated and have flanged panels that bolt together, eliminating the need for contracting skilled welders. Each tank's interior is coated with Trico-Bond 478 epoxy, which is noncontaminating, corrosion-resistant, and baked on under factory-controlled conditions. The coating can withstand the temperatures ideal for storing PCC. The producer's average satellite installation requires about 12 silos and tanks. Capacities range from 10,000 to 350,000 gallons.

All silo and tank erection is now done by builders contracted by the manufacturer. "We have what I'll call standard erectors," said Yaple. "Now we can install all of our silos and tanks around the world with consistent labor, which is important to us."

PCC producer achieves all of its goals and more

Although Specialty Minerals' study concluded that bolted tanks could save about 4 weeks on erection, experience showed an even better result. "Erecting all of the silos and tanks at a new satellite plant takes about 5 to 6 weeks now," said Yaple. This is an improvement from the 10 to 12 weeks it took when the tanks were welded. "It varies because some installations have 5 storage vessels, some have 20. But compared with an equivalent number of welded tanks, the bolted units go up in about half the time they used to." A lot of the time savings results from eliminating welding, but most comes from eliminating all field painting. "All we have to do now is put gaskets on flanges, put bolts through them, and tighten nuts," Yaple said. "We don't have to get a guy in there with welding equipment, a sandblaster, or a paint gun. We're no longer at the mercy of so many variables."

Along with the time savings, the producer has realized cost savings on

labor and materials because lighter weight steel can now be used. "The time and cost of getting these tanks ordered, erected, and operational is half what we used to experience," said Gallagher. "This in turn helps us streamline the process of getting these plants up and running."

Engineering inconsistency is also eliminated because all silo and tank engineering is now done by the vessel manufacturer. And the final problem, PCC contamination, is also gone. "With the factory-coated, bolted tanks, we've been storing the PCC at temperatures from 130°F to 170°F with no coating breakdown or PCC contamination," Gallagher said.

Switching to the bolted tanks has brought a few other benefits as well. If a tank ever needs to be expanded or relocated, it's a relatively simple task. Another plus is that pricing proposals are now significantly more accurate. "Before, when we put together proposals for building satellite plants around the world, we never knew exactly what the PCC tanks were going to cost us," said Yaple. "Now, wherever the installation is, we know exactly what the cost will be. All we have to do is add shipping. That's a real benefit — identifying project costs."

A final, unquantifiable reward the producer continues to receive, Gallagher said, is that "the manufacturer's engineers, erection teams, and sales and support staff have come to know Specialty Minerals and our needs. I don't know how you quantify the benefit of working with the same supplier team each time, but it's a very important efficiency that flows straight to the bottom line." **PBE**

**Columbian Steel Tank, Kansas
City, KS
913/621-3700**