Press Release

The world's first earthquake proof whole milk drying plant by GEA for Fonterra starts production

Düsseldorf (Germany), November 10, 2015 – GEA has built a unique whole milk drying plant for Fonterra in New Zealand. It's unique not because of its size which, at 15 tons/hour is amongst the biggest in the world; not for the speed of its construction which, at under two years is fast by global standards; but for its construction: The plant at Pahiatua is on an earthquake fault line and has been designed to withstand a 1/2500-year event without damage. It is believed to be the first plant of its kind in the world to be built in this way.

The small town of Pahiatua in New Zealand's North Island was last hit by a major earthquake in 1934 when it was devastated by a 7.6 magnitude shock. However, in all other respects the plant is ideally located for the dairy farms it serves, avoiding the need for tankers to traverse the Manawatu Gorge which can be dangerous in bad weather.

Building a plant in the middle of New Zealand's earthquake zone requires special precautions. In an effort to speed the process, and keep costs, down it was agreed not to design a new facility that would withstand tremors but to build a copy of the company's Darfield 1 Dryer but with base isolation that would allow the building to move should a quake hit. As well as providing all the processing equipment, GEA was also contracted as a consortium to provide the building work for the project with its partner Ebert Construction. There are only a handful of other buildings in New Zealand that are protected in this way including the parliament building in Wellington and the country's national museum. For a commercial plant, this is a first.

GEA has many reference sites in New Zealand for this type of plant including Darfield 2 that operates the world's largest milk powder dryer. The company supplied all the processing equipment including: milk reception, storage, wet processing including standardization and homogenization, evaporation, drying, powder handling, packing and water recovery. Most of the equipment was built by GEA locally in New Zealand with some specialist items coming from the company's factories in China.

According to Gary Reynolds, GEA's Project Manager, the plant was straight-forward in its design except for the base isolation construction. "All these plants are difficult because of their sheer size, but this was similar to many plants we have built in New Zealand," he said.

The site does, however, include a reverse osmosis plant capable of processing up to 2,000,000 liters a day of 'cow water' (water recovered from the milk drying process) and purifying it for reuse in the plant making the new plant (P3) virtually self-sufficient in water. "This treated water is returned to the process, keeping disposal costs down and ensuring that Fonterra has no need to increase its water resource consents," said Gary. "The RO plant will also produce boiler feed water of very high quality using less chemicals to protect the steam system from corrosion, increasing the life expectancy of the plant and reducing operating costs."

Base isolation

The whole plant weighs upwards of 20,000 tons, including its 40-metre-high drying tower, all of which sits on 50 triple friction pendulum bearings that will allow the whole construction to move up to 900mm in any lateral direction allowing the building to withstand a 1/2500 year event without losing its structural integrity. Each 1.4m square bearing weighs 2.7 tons and has a Teflon center to reduce friction. The bearings were supplied by a seismic bearing specialist company in San Francisco.

Other key elements of the construction include: 3,400m^3 of concrete reinforced with 400 tons of steel; the main columns are 17.5 meters long and weigh 16 tons each; and the tower walls are constructed using 517 concrete panels each of 9 tons stitched together using poured concrete.

Although the main building is base isolated the ancillary structures are not, which gave GEA some engineering challenges. For example every supply line for steam, acid, milk, gas, chemicals or electricity has to be able to withstand the building moving by up to 900mm in any plane. "We have used a seismic loop on all the supply lines that gives them enough slack while being supported adequately as well," said Gary.

The human interface zones (corridors between the fixed and base isolated sections) also have to be able to move too as the building operates under critical hygiene conditions making any breach to ambient air unacceptable.

Although the plant was a copy of Darfield 1, which meant all the stainless steel components were ready well ahead of schedule, designing and building a plant such as this is not without its difficulties. The building is made from pre-cast concrete panels and columns fabricated in Otaki, on the island's west coast, and lifted into position. As well as being quick to erect they also provide excellent sound insulation. Gary explained, however, that the 1200mm-square main columns were just too big to be made off site and had to be constructed and poured *in situ*. However by working closely with Fonterra any potential problems were quickly overcome.

"Our goal was to change the way construction was done in New Zealand," explained Gary. "We brought the whole team together in a 'community' in which GEA and Fonterra work side-by-side. There had to be absolute cooperation between us, the client and the builder. There was some steep learning but if we had a problem we just talked it through and found a solution together. It is a very refreshing approach. If we had a disagreement we'd get it out in the open and deal with it."

The plant is now commissioned and was on product on 18 August less than two years since GEA received the order. In global terms that is quick for an ordinary plant but for a unique, market leading project like this it's extraordinary.

Fonterra now has another industry leading site in New Zealand to which the dairy farmers of the North Island have easy, year-long access.

Fonterra plant at Pahiatua

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