2922 North Division Avenue • PO Box 366 • York, NE 68467-0366 • 402-362-2000 • 800-445-0730 • Fax 402-362-2001 • sales@cyclonaire.com • www.cyclonaire.com

cyclonaire®

PNEUMATIC CONVEYING SYSTEMS

CASE STUDY:
Olivenhain Dam

Cyclonaire Speeds Olivenhain Dam Construction

Turbo-Inductor installation adjacent to storage silos has four stations – each with a double inlet that allows one PD trailer in a tandem rig to unload while the other is hooked up and ready for its turn.

Background

In 1988, concern over the effects of a major earthquake or drought in southern California prompted the San Diego Water Authority to establish a $1.2 billion Capitol Improvement Program intended to help protect the region's $117 billion economy. The biggest part of the program is the Authority's $827 million Emergency Storage Project, designed to substantially increase the amount of stored water available in the county. One of the first and largest components of the overall water storage project is the Olivenhain Dam and Reservoir. When completed, the Olivenhain Reservoir will ensure that San Diego County has up to 24,000 acre-feet of water ready to use in the event of an emergency. In 2001, when construction began, Cyclonaire Corporation became a key player in the rush to get the dam built within one year.

Kiewit of Omaha, Nebraska, one of North America's oldest and largest construction companies, was selected as general contractor for this massive project. **Con-E-Co** of Blair, Nebraska, was chosen to build the on-site batch plant that would supply Kiewit with the 1.4 million cubic yards of concrete needed to complete the structure. Cyclonaire had worked with Kiewit on other major projects and was selected to provide the equipment needed to unload the supply trucks and to convey materials from storage to the batch plant.

The Problem

Actual construction was not cleared to start until October 2001; nevertheless, the San Diego Water Authority set the project completion date for mid-summer 2003. So the work had to be finished on a fast-track schedule. The dam's engineering specifications called for Olivenhain to be the first roller-compacted concrete (RCC) dam in California. Roller-compacted

concrete is similar to regular concrete but offers several advantages for dam construction. It is less expensive, requires less water, and generates less heat as it cures. A roller-compacted concrete dam is as strong as a conventional concrete dam and can withstand natural disasters equally well. What's more, it can be built in one-third to one-half the time. But roller-compacted concrete must be applied in layers and requires uninterrupted pouring to allow for proper bonding of the layers. So the method of construction presented a significant hurdle in an already demanding timetable.

The Olivenhain location contributed two other time-related problems. First, the only road to the construction site ran through a residential area located in a narrow canyon. Consequently, environmental considerations demanded that the transport and unloading of raw materials be done only on weekdays during daytime hours - Monday through Friday between 7 a.m. and 4 p.m. Unloading enough truckloads of fly ash and cement to sustain production would require tight thirty-minute cycles between hookup and departure. Second, because daytime temperatures in the area could reach 100ºF, processing and pouring the roller-compacted concrete could only be done during the night and the coolest times of the day to allow it to cure properly.

The Solution

Time pressure demanded that specially designed high-performance equipment be used. Granite quarried on site would be crushed to various sizes and supply the aggregate for the concrete, but the cement and fly ash would be hauled in. With those deliveries restricted to nine hours a day five days a week, trucks had to be unloaded very rapidly to supply the seven-day construction schedule. Significant on-site storage was also needed. With the processing and pouring of the concrete limited to about sixteen continuous hours a day, high-capacity material conveying and mixing would be required.

Innovative Cyclonaire Trailer Unloading Systems

To help meet the tight delivery cycle deadlines, Cyclonaire supplied a pneumatic truck unloading-assist system, which it calls the Turbo-Inductor. Because of the enormous amounts of fly ash and cement necessary for the project and the aggressive batching output, a large number of bulk trucks were needed to meet the critical material delivery

Compact electric-powered Cyclonaire Blower Packages connected by buried pressure lines to Turbo-Inductors feature high-quality filters and hostile-duty motors for long service life.

schedule. The delivery vehicles ranged from standard two-axle trailers to tandem trailers. The discharge outlets and configurations varied widely from trailer to trailer. So engineers from Cyclonaire met with Kiewit and Con-E-Co to define trailer and discharge parameters. Special Turbo-Inductors and their accompanying air supply equipment were then custom-tailored to accommodate the variations in delivery vehicles.

Turbo-Inductors provide a fast, efficient way to unload bulk materials from pneumatic trailers at high rates over long distances. The Olivenhain site configuration and the number of trailers discharging simultaneously would keep the trailers at some distance from the storage silos. With longer convey lines required, longer unloading times would result. Cyclonaire's Turbo-Inductors are designed to overcome such problems by enabling trailers with standard 4- or 5-inch discharge lines to be unloaded at much higher rates. They achieve this by stepping up to larger diameter lines – 8-inch lines in this case – without any modifications to the various trailers servicing the site. The same type of system can also be used to speed up bulk railcar unloading.

Cyclonaire supplied Turbo-Inductors to outfit four unloading stations so that four trucks at a time could discharge their contents. Each of the four units had inlet adapters for single or double trailers. With double trailers, while one trailer was discharging, the other trailer could be hooked up to the system and prepped to start unloading as soon as the first one was finished. An integrated control system with diverter valves allowed the off-loaded fly ash to be routed automatically to the appropriate batch plant or storage location.

Cyclonaire Turbo-Inductor Systems are self-contained and include the Turbo-Inductor, a blower sized specifically for the application, connecting hoses, and a control system housed in a NEMA-4-rated enclosure. Blower capacity, air pressure in the lines, and dust collection are all balanced, increasing overall conveying efficiency and eliminating the risk of plugged lines or accidental dust discharge.

High-Capacity Batching and Conveying

Con-E-Co solved the high-rate concrete processing problem by constructing the highest-capacity roller-compacted concrete

Turbo-Inductor installation with lines ready to connect to PD trailers.

Trailers loaded with fly ash line up to unload their cargoes into bulk storage silos.

plant ever built. Based on its Lo-Pro batch plant design, this custom-built Con-E-Co plant was capable of producing 1,200 cubic yards of RCC per hour. To solve the problem of feeding cement to this super-sized plant, Kiewit installed three previously used 30-TPH Cyclonaire Gravity-Feed Conveyors that it brought from one of its construction sites in Utah. To supply the fly ash, Cyclonaire custom built a pneumatic conveyor to meet a 108-ton-per-hour fly ash transfer requirement.

Cyclonaire's big custom GF-100 Conveyor was located beneath six large low-profile fly ash silos built by Con-E-Co to withstand moderate seismic activity. The conveyor was designed with six 12-inch inlets especially for this installation. The two inlets fed by silos directly overhead were equipped with dual stacked automatic butterfly valves to control material flow. The four other inlets used single valves and were fed by Cyclonaire Air Shoot™ gravity conveyors that convey fluidizable materials along their inclined ramps on a cushion of low-pressure air. From its transfer vessel, the GF-100 conveyed the fly ash through a 10-inch line to the batch plant and achieved transfer rates in excess of 150 tons per hour. The air supply for the GF-100 was a 2,050-scfm-blower package driven by a 250-hp motor.

The three standard GF-30s were installed beneath three Portland cement silos. These conveyors were set up to transfer cement to the batch plant through 5-inch pneumatic lines. Each had a dedicated convey air blower and automated controls provided for minimal operator supervision. Neil Smith, President of Con-E-Co, notes, "Without all the Cyclonaire conveyors and controls, we couldn't have achieved the output our batch plant was designed to deliver or kept to the project timetable."

Cyclonaire GF Series Conveyors are gravity-loaded, semi-dense phase pneumatic units specifically engineered to handle abrasive materials like cement. They use medium-pressure air from high-efficiency 15-psig blowers to convey materials. Cycling between loading and unloading the transfer vessel is automatic. A high-level monitor senses when the conveyor's transfer vessel is full and automatically switches to the pressurized discharge cycle to convey material from the vessel to its destination, eliminating the need for operator supervision.

The Advantages

Turbo-Inductor Systems eliminate the need to use tractor-mounted blowers, thereby saving fuel and wear and tear on the vehicles. Nor were trailers modified in any way. Once the units were set up at the Olivenhain site, daily operation was routine. The demand on operator time was largely limited to making hose connections, saving labor. By adding a controlled volume of air to the conveyed bulk material, the Turbo-Inductors delivered more product down the larger diameter lines in less time and significantly sped trailer unloading. These systems achieved fast, 29-minute turnaround times to meet the demanding unloading schedule and tallied up savings all around.

Both Cyclonaire's new customized fly ash conveyor and its refurbished cement conveyors proved to be reliable performers that could handle product at

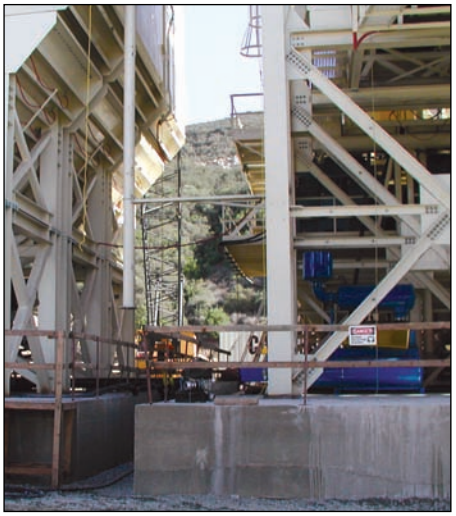
very high volumes around the clock, seven days a week. According to Joe Morris, Cyclonaire Vice President of Sales and Marketing, "Conventional conveying systems often have significant problems with component and overall system wear when moving materials like fly ash and cement. But because of their unique design, Cyclonaire Conveyors are especially well suited for handling abrasive product. For one thing, there are no close-tolerance machined parts in direct contact with the conveyed material. Our modular system design helps, too. If repairs are needed, they can be made quickly and economically by changing out individual components with the machine in place."

High-capacity Cyclonaire GF-100 Conveyor located beneath the rectangular silos supplies fly ash to the world's largest RCC batch plant, built by Con-E-Co.

Current Status

The construction of the dam was completed with the recent "topping off" on October 31, 2002. Work continues on the project's remaining components, such as the inlet/outlet tower, the dam's crest roadway, downstream flow-control facilities, and mechanical and electrical installations. All are on schedule to meet the 2003 completion date.

The Olivenhain Dam will be a critical asset in San Diego's future water supply system, and, by any standards, it is an impressive engineering accomplishment. In cross-section, the dam is 250 feet wide at the base and 20 feet wide at the crest. It is 318 feet tall and 2,552 feet long and boxes off a natural canyon. Environmental mitigation requirements have been incorporated into the final stages of the Olivenhain project, just as they were in its initial planning and construction. It was sited so as not to block any stream or river. The face of the dam will be stained with a color that blends into the natural surroundings of the area, and a 750-acre park and recreational area will surround the dam and reservoir. The reservoir area will offer 17 miles of hiking, mountain biking, equestrian trails, and viewing points. The reservoir environment has been planned so that it will protect and sustain the area's wildlife and natural resources.



Like standard Cyclonaire Conveyors, the big GF-100 uses 15-psig convey air to move materials at the right combination of line velocity and material-to-air ratio to minimize abrasion and degradation and to maximize efficiency.

The filling of the 200-acre reservoir will begin in summer 2003, and the dedication of the Olivenhain Dam is planned for fall 2003. When full, the reservoir will hold 7.8 billion gallons of water – enough to sustain San Diego County through a two-month water outage or to provide water to 192,000 people for a year. From the anticipated start date of July 2003, it will take approximately one year to fill the Olivenhain reservoir. To accomplish this, 14,000 feet of 78-inch-diameter welded-steel pipe was laid between the Water Authority's Second Aqueduct and the reservoir. The water in the aqueduct is imported via the Colorado River Aqueduct and the State Water Project's California Aqueduct.

Cyclonaire Capabilities

Cyclonaire Corporation has been manufacturing a broad array of standard and custom pneumatic bulk material handling equipment and controls since 1973. Typical applications include bulk transfer for storage and in-plant processing, as well as process-related handling of powdered, granular, and pelletized dry materials. The company supplies single components as well as complete vacuum-, pressure-, and vacuum/pressure-based pneumatic conveying systems. Its services range from concept engineering and project management through start-up supervision. Industries served include cement, chemical, battery, food, foundry, milling, mineral, railroad, and rubber.

To see photographs, dimensional drawings, and specifications for Cyclonaire Conveyors and other related products, visit the Cyclonaire Web site at www.cyclonaire.com. For more information and free literature, contact:

Cyclonaire Corporation
PO Box 366
York, NE 68467-0366
1-800-445-0730
or 1-402-362-2000
or e-mail sales@cyclonaire.com.