6 Unnecessary Risks to Eliminate in Your Plant

A Problem-Solving Checklist to Help You Maximize Worker Safety Through Plant Digitization

PART OF HEXAGON

Leica Geosystems

INTRODUCTION

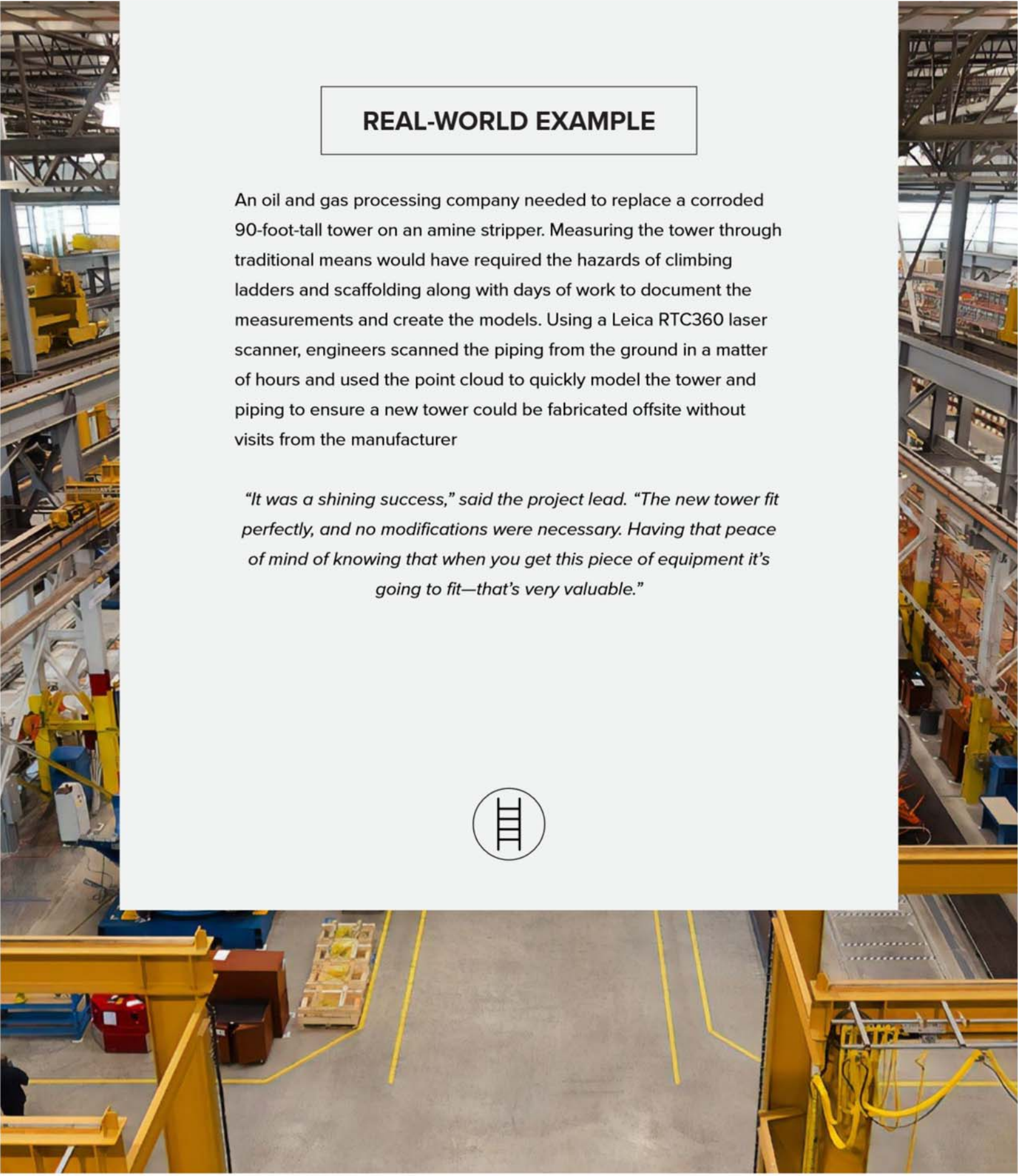
Every 99 minutes, someone in the U.S. dies from a work-related injury. An additional 2.8 million people are likely to sustain non-fatal workplace injuries or illness this year, with approximately 15 percent of these incidents occurring in manufacturing.* While adherence to rigorous safety standards and training is helping to reduce these numbers over time, more efforts are needed to safeguard workers and prevent accidents. Increasingly, industrial plants are turning to digitization as a primary safety strategy.

With reality capture technology such as 3D laser scanning, accurate as-built data can be safely and quickly captured across an entire plant to create a comprehensive digital twin. A noncontact and nondestructive method of digitally capturing physical objects in 3D using a beam of light, or laser, 3D laser scanning has long been the standard for surveyors and engineers to obtain accurate measurements and complete as-built documentation for plant retrofit and upgrade projects. Within the last several years, laser scanners have been developed that make it possible to complete a full scan in as little as 26 seconds. Software advances have made working with point clouds fast and easy, even when integrating point cloud data into existing CAD workflows.

As a result of these and other developments, employees across organizations as well as outside contractors are finding increasing value from point cloud data captured with 3D laser scanning.

From a safety standpoint, a digital remote management strategy built on a solid foundation of accurate, comprehensive point cloud data is helping facilities minimize or even eliminate six common risks—and transform the safety of their operations.

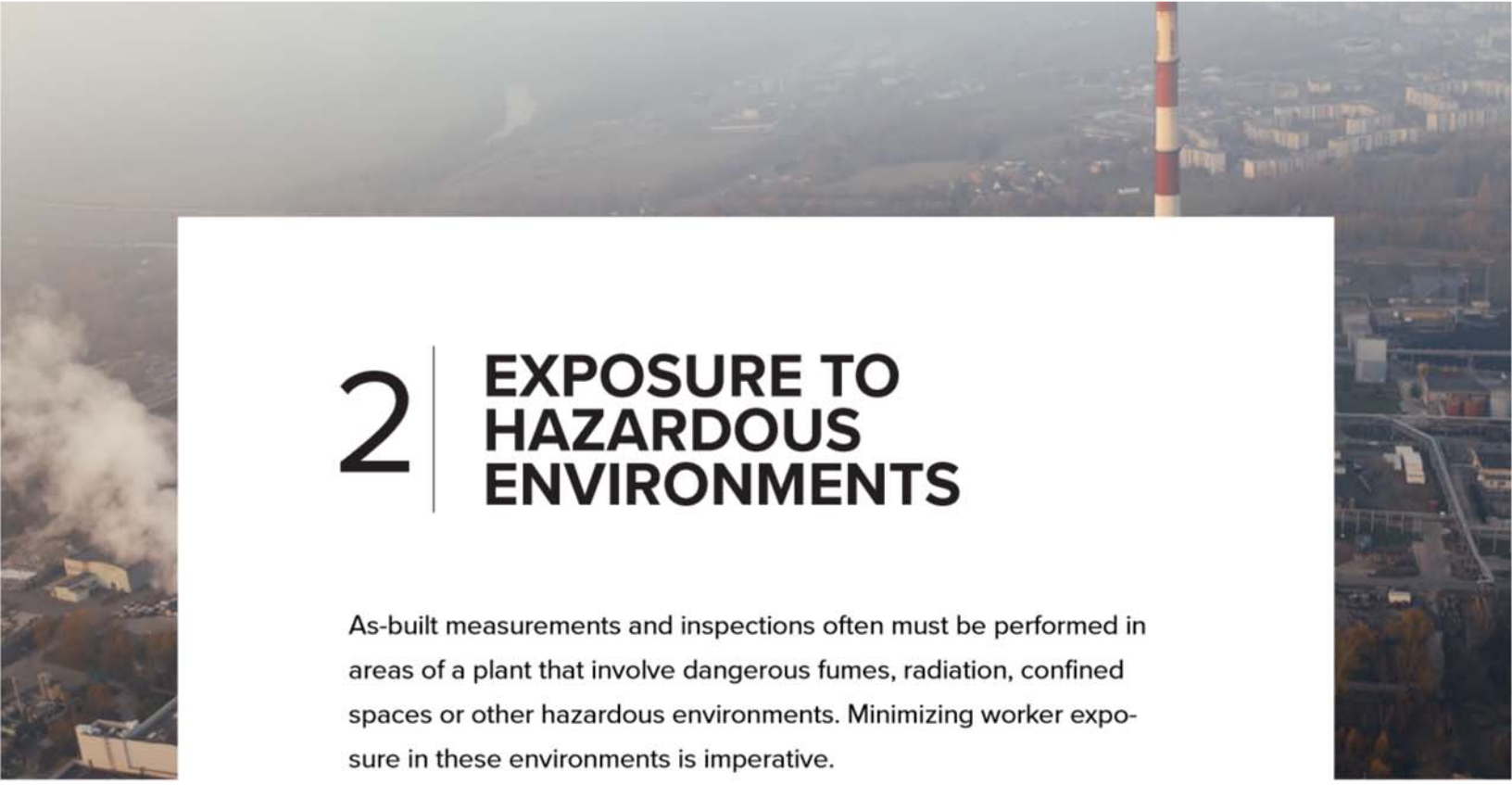
*Statistics based on 2019 data from the U.S. Bureau of Labor Statistics, https://www.bls.gov/news.release/cfoi.nr0.htm, https://www.bls.gov/news.release/pdf/osh.pdf; see also https://www.osha.gov/data/commonstats



REAL-WORLD EXAMPLE

An oil and gas processing company needed to replace a corroded 90-foot-tall tower on an amine stripper. Measuring the tower through traditional means would have required the hazards of climbing ladders and scaffolding along with days of work to document the measurements and create the models. Using a Leica RTC360 laser scanner, engineers scanned the piping from the ground in a matter of hours and used the point cloud to quickly model the tower and piping to ensure a new tower could be fabricated offsite without visits from the manufacturer

"It was a shining success," said the project lead. "The new tower fit perfectly, and no modifications were necessary. Having that peace of mind of knowing that when you get this piece of equipment it's going to fit—that's very valuable."



2 EXPOSURE TO HAZARDOUS ENVIRONMENTS

As-built measurements and inspections often must be performed in areas of a plant that involve dangerous fumes, radiation, confined spaces or other hazardous environments. Minimizing worker exposure in these environments is imperative.

Here, too, digitization with 3D laser scanning provides a solution. With a laser scanner, you can capture complete, accurate information from a distance quickly. In fact, the fastest laser scanner available completes a full scan in as little as 26 seconds. This means you can capture comprehensive data in a fraction of the time compared to other measurement methods. All of this data can be collected safely with a single operator working alone.

Once the data is captured, cloud-based software enables you to quickly and easily access the data from anywhere on any device, even if you aren't familiar with CAD or 3D datasets. You can virtually visit the site without any safety concerns or delays, take snapshots, make measurements, and create markups with notes and links.

"The Leica scanners were capable of capturing full-volume, 360-degree, 3D point clouds in about three minutes. Some rooms required only a single setup, which resulted in minimal exposure times to the harsh nuclear environment."

REAL-WORLD EXAMPLE

A nuclear power plant needed to assess potential corrosion in critical pipe systems in a pressurized water reactor. Identifying the high points and installing vents would alleviate any trapped gas, but manual methods would expose personnel to high levels of radiation, potential contamination and unsafe processes using ladders and scaffolding.

The solution was to use 3D laser scanning. While wearing full radiation-protection suits, personnel scanned piping from safe locations on the ground in more than two dozen rooms throughout the power plant using Leica P-Series professional-grade laser scanners. The Leica Geosystems scanners captured full-volume, 360-degree, 3D point clouds in about three minutes. Some rooms required only a single setup, which resulted in minimal exposure times to the harsh nuclear environment. Once a scan is initiated, the data acquisition is completely automated, allowing the operator to retreat to low-dose areas while critical data continue to be captured by the scanner.

Software algorithms then provided a function to extract all pipe sizes, centerline, and position, even when only part of the pipes were scanned. As an added benefit, the dense point cloud obtained revealed areas of crystallization, which indicated leaks in the pipes.

Once scanning was completed, 3D CAD models were generated, and computer snapshots were recorded with elevation descriptors marked on each side of the pipe runs. The report showed a graphical description of the model pipes with the elevation provided in a PDF format. These reports were sent to the facility engineers to determine if there was a need to install vents at specific locations on the pipe runs.

3 IMPROPER USE OF FALL-PROTECTION PPE

Safety harnesses, fall and rescue devices, and confined space entry systems are all standard personal protective equipment (PPE) for personnel involved in operations such as tank calibration/maintenance and other work that must be performed at heights. But these systems require proper and consistent use to keep workers safe.

A better approach is to eliminate the hazards and minimize the need for fall-protection PPE by using 3D laser scanning. Laser scanning keeps workers out of harm's way while providing the reach to capture data wherever it's needed. The data can then be brought back to the office in a 3D environment to obtain measurements and generate reports that wouldn't even be possible with manual methods.

"Instead of capturing a couple hundred measurement points on a tank, we were able to safely capture millions or billions of highly accurate points from the ground, which provided much more clarity on the tank's condition and status. We were able to bring that tank back into the office in a 3D environment and obtain measurements we couldn't have gathered before due to the risk of inaccuracies or incomplete data."

REAL-WORLD EXAMPLE

Deep within the rock of a volcanic mountain ridge, 20 steel-lined upright cylindrical tanks stand encased in concrete. Each tank measures 100 feet in diameter and 250 feet tall and can store 12.5 million gallons of fuel. Careful inspection and maintenance of the tanks is crucial to protect the region's drinking water supply and maintain the storage facility as a strategic resource. But how can comprehensive measurement data be safely obtained on such tall tanks below ground?

"The conventional approach for any kind of tank calibration or survey is to use a linear measurement method, such as total stations or tape measures," says D'Arcy Trask, high-definition survey specialist and owner of Gauge Point Calibration Inc., based in Crockett, Calif. "But that really limits the amount of information you can capture on a tank; you might only be able to get about 250 points of measurement with those methods, and you're working at elevation with tie-off and fall protection, trying to get the data you need. It's hazardous, time consuming and prone to error. The best approach – and really the only approach for complex situations like tall underground storage tanks – is to rely on 3D laser scanning."

The tanks were scanned from the inside and outside to create registered models. The comprehensive scan data captured on the tanks could also be used to create calibration reports; manage operational risk; monitor for damage, overfill and environmental levels; and create maintenance and inspection reports.

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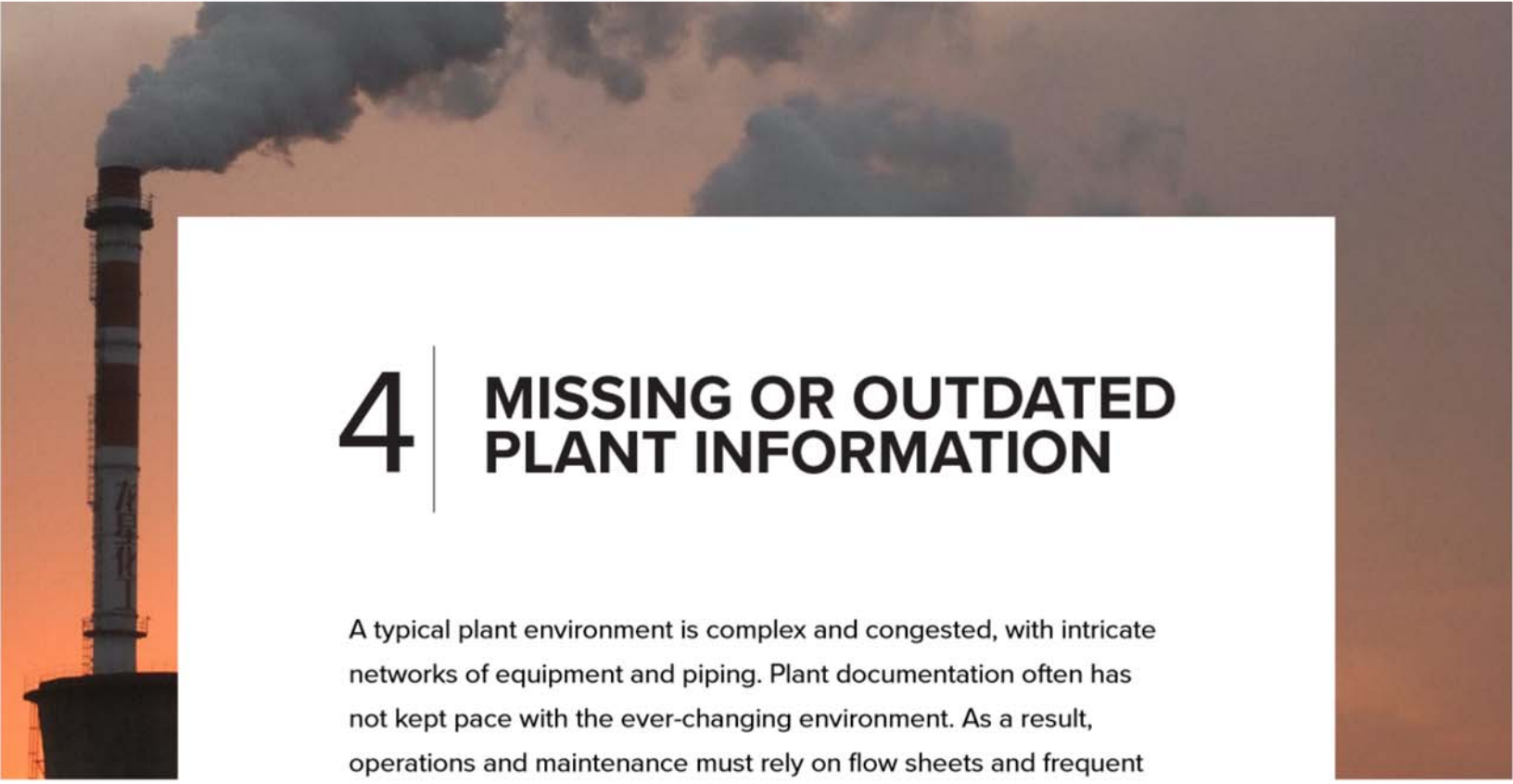


4 MISSING OR OUTDATED PLANT INFORMATION

A typical plant environment is complex and congested, with intricate networks of equipment and piping. Plant documentation often has not kept pace with the ever-changing environment. As a result, operations and maintenance must rely on flow sheets and frequent visits to the plant to obtain and verify information. When new changes are needed for upgrades or retrofits, designers and engineers must spend time in the plant capturing accurate as-is documentation before the project can begin.

These challenges can be avoided by digitizing your plant with 3D laser scanning. The resulting high-detail virtual point clouds can be quickly referenced through a few clicks on a computer or taps on a mobile device. The comprehensive and accurate data enables virtual walkdowns and true digital remote management—minimizing the amount of time workers must spend in the physical plant.

"Once you've captured the data, you have a complete, comprehensive dataset that you can go back into at any time and continue to pull information from it. Instead of models and drawings that are outdated as soon as they're complete, you have a living, breathing digital twin of your facility that you can continue to use over time for operations and maintenance, or future renovation projects."

REAL-WORLD EXAMPLE

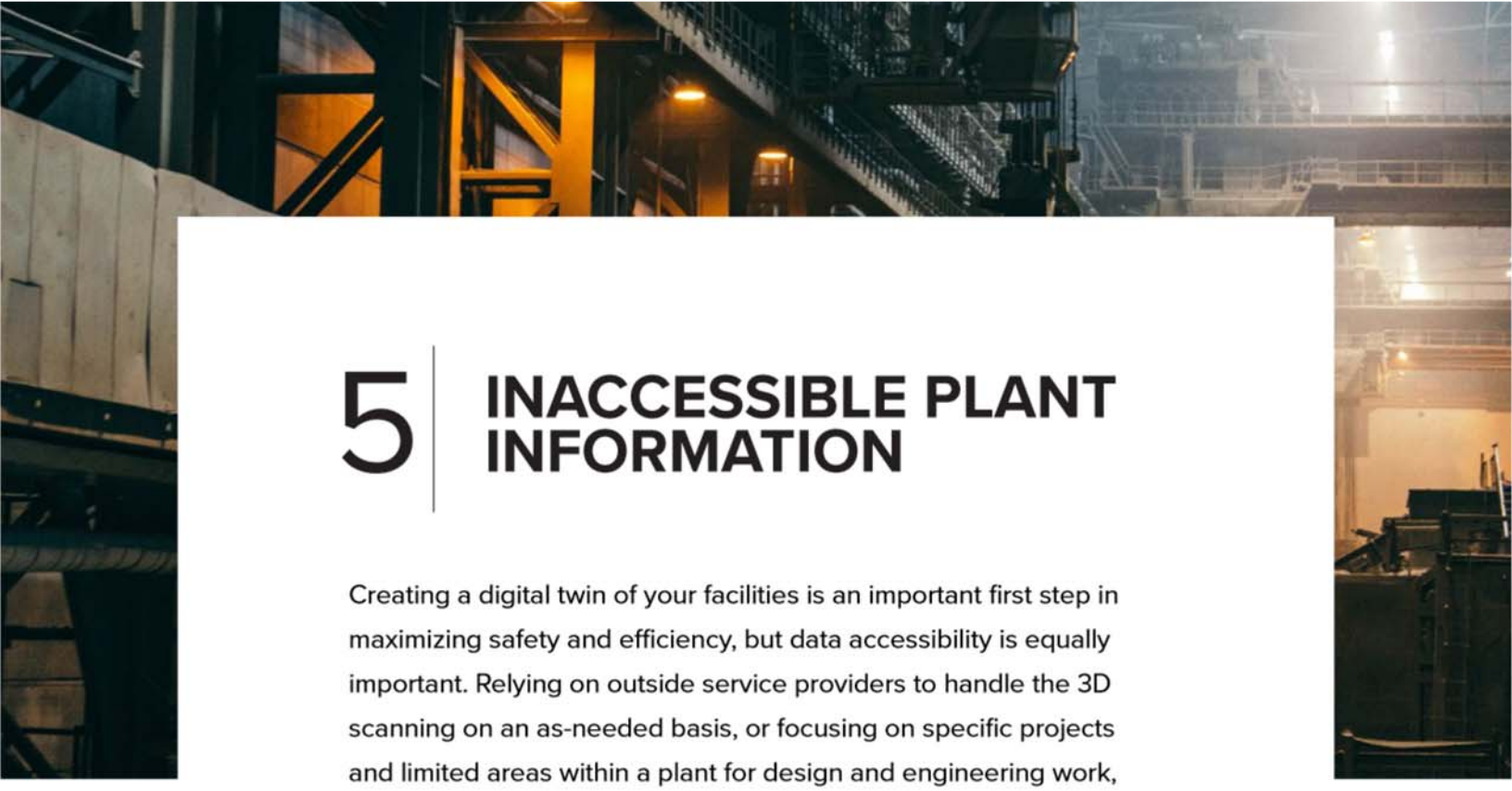
When "JIFFY" Mixes launched an initiative to upgrade its retail packaging operation, the company recognized that its plant documentation process needed to change. "The paper drawings of the plant [from the late 1960s and early 1970s] were unreliable," said Director of Manufacturing Scott Denny. "We knew that as we continued to upgrade the facility, we would need accurate, complete documentation to do so effectively. That led us to laser scanning."

The company contracted Wightman to do the scanning work. Beginning with a Leica ScanStation P40, a rugged professional-grade laser scanner that provides fast, full-dome, survey-grade scanning at a long range, Michael Pfaff, Wightman's reality capture practice area leader, systematically began capturing accurate as-is data throughout the plant that would enable all future design drawings to be based on real-world conditions. Wightman also used a high-speed Leica RTC360 scanner to streamline data capture onsite.

"One of the benefits that really stood out to us was the ability to capture accurate documentation on the entire plant without affecting production," says "JIFFY" Mixes Project Engineer Rick Rabideaux. "It was exactly what we needed."

The data enabled the company to implement its packaging equipment upgrade project quickly, safely and with minimal rework. The company sees significant potential to apply the data in other ways in the future.

"Once you've captured the data, you have a complete, comprehensive dataset that you can go back into at any time and continue to pull information from it," Pfaff says. "Instead of models and drawings that are outdated as soon as they're complete, you have a living, breathing digital twin of your facility that you can continue to use over time for operations and maintenance, or future renovation projects."



5 INACCESSIBLE PLANT INFORMATION

Creating a digital twin of your facilities is an important first step in maximizing safety and efficiency, but data accessibility is equally important. Relying on outside service providers to handle the 3D scanning on an as-needed basis, or focusing on specific projects and limited areas within a plant for design and engineering work, can cause you to miss out on valuable assets. Maximize 3D data collection by using a central infrastructure that can benefit your toolkit. Make sure personnel knows where the scans are stored and how to access them.

With the right approach, all aspects of day-to-day functions that rely on plant data will be digitally enabled. Staff will be able to visually inspect any area of the plant remotely through their web-browser. New employees can be trained through virtual walkdowns. Maintenance will know exactly where they're going and what they'll encounter in the plant because they'll be able to examine the area before they get there. Engineering will be able to streamline projects by having access to measurements and visualizations with no more guesswork or discrepancies in as-built drawings.

"There are no unknowns anymore. We've experienced significant improvements in communication and efficiency."

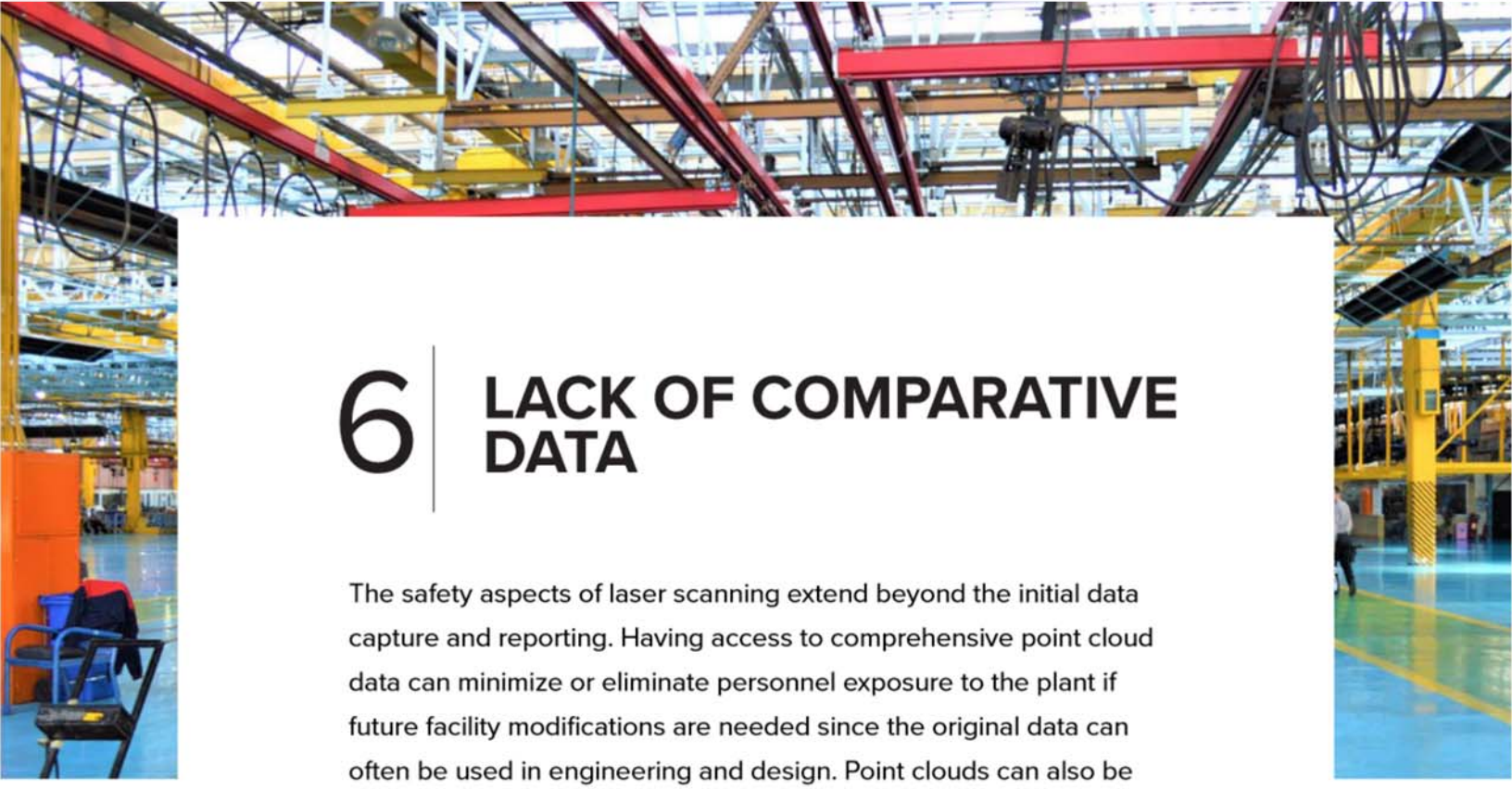
REAL-WORLD EXAMPLE

A project to replace the scaffolding in a nuclear power plant service water pumphouse with a permanent access platform ignited the desire at Ontario Power Generation (OPG) to have laser scanning technology within the organization. The benefits of 3D visualization were immediately evident, and construction went smoothly with no field-initiated changes or work stoppages.

OPG embarked on a complete digital transformation under a team led by Jaydev Chauhan, project engineer for the Refurbishment Innovations at Darlington Nuclear Generating Station. The company purchased several Leica RTC360 laser scanners along with JetStream, TruView Enterprise, Register360 and CloudWorx for Solidworks software. Within six months, the scanning team had completed more than 3,000 scans for countless projects, and more than 900 internal users were finding value in the published scan data and imagery in TruView. Two years later, that number had grown to more than 2100 employees (and counting).

“There are no unknowns anymore,” says Chauhan. “We’ve experienced significant improvements in communication and efficiency.”

With the combination of the scanning and imaging technology in-house, and the greater ability to manage vendor-supplied scanning content, OPG is able to systematically maintain accurate digital records that support its digital remote management strategy. Plant modifications are scanned and published as part of a standard operating procedure to ensure the digital records stay up to date, and the benefits of the digital data continue to grow.



6 LACK OF COMPARATIVE DATA

The safety aspects of laser scanning extend beyond the initial data capture and reporting. Having access to comprehensive point cloud data can minimize or eliminate personnel exposure to the plant if future facility modifications are needed since the original data can often be used in engineering and design. Point clouds can also be compared to original as-builts or older scan data to identify areas of deformation before they cause problems, reducing risk and repair costs.

If an incident does occur, scan data can be used to support the investigation and identify the cause of the failure so preventive measures can be implemented.

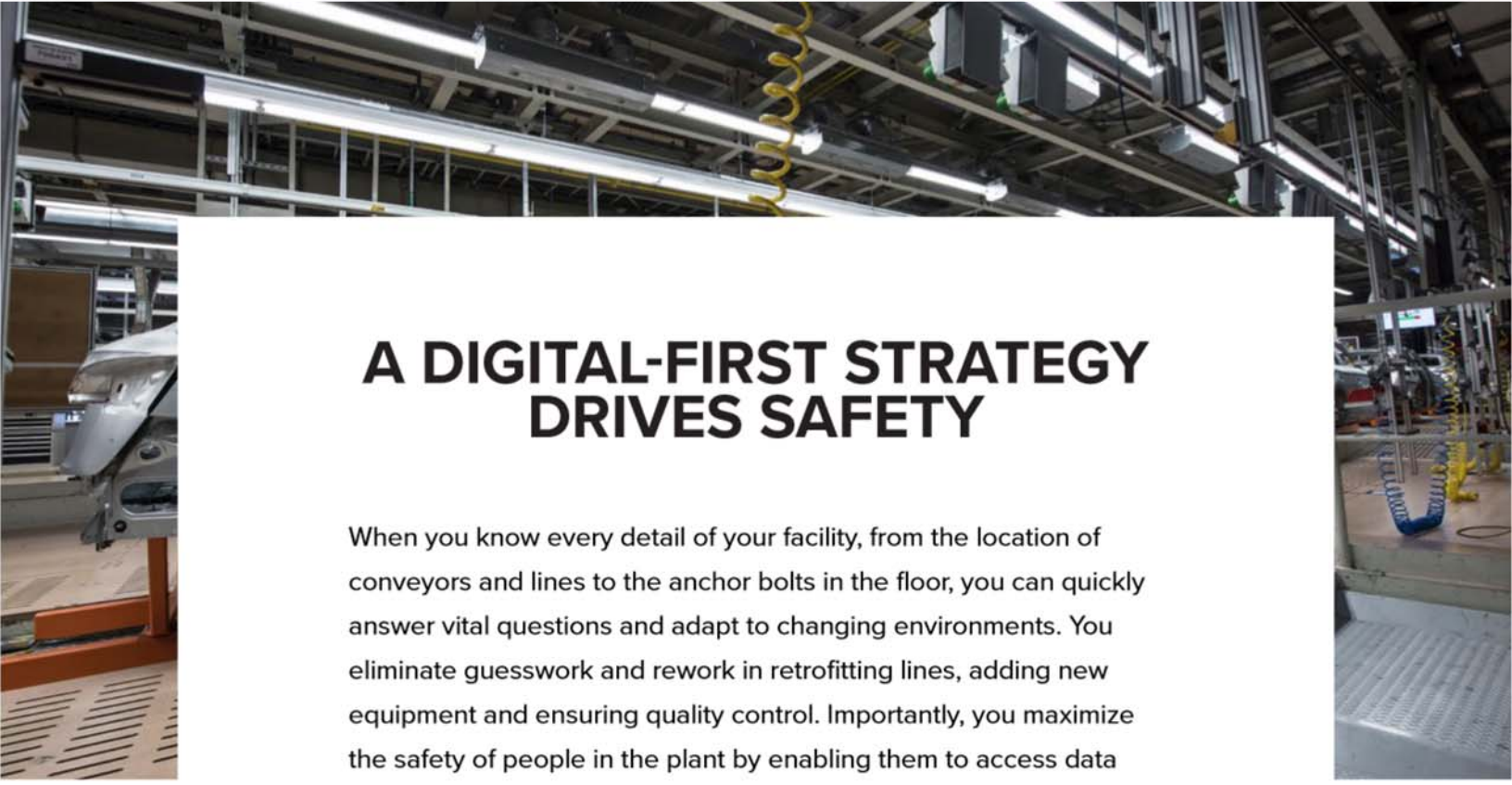
"Once you have the point cloud data, you can use it to create reports, calculate capacity, identify problem areas, manage operational risk, model spill scenarios and optimize efficiency. High definition surveying with 3D laser scanning is an enabling technology that delivers tremendous value."

REAL-WORLD EXAMPLE

An increased focus on corporate responsibility is driving demand for high-definition secondary containment surveys, especially for facilities located near waterways and other environmentally sensitive areas. In one case, after a traditional survey indicated a potential containment capacity shortage at an oil and gas facility, the owner contracted Gauge Point Calibration to resurvey the facility with 3D laser scanning. Gauge Point's high-definition surveys and digital data models proved the secondary containment was sufficient, saving the facility hundreds of thousands of dollars in unnecessary renovation costs.

The point cloud data also has long-term value, especially when laser scanning is used to capture entire tank and terminal operations. If future facility modifications are needed to add capacity or improve efficiency, owners and operators can return to the point cloud dataset to minimize or even eliminate the need for additional site surveys.

"Laser scanning is a very powerful intelligence tool for facility owners and operators," says D'Arcy Trask, Gauge Point president and founder. "Once you have the point cloud data, you can use it to create reports, calculate capacity, identify problem areas, manage operational risk, model spill scenarios and optimize efficiency. High-definition surveying with 3D laser scanning is an enabling technology that delivers tremendous value."



A DIGITAL-FIRST STRATEGY DRIVES SAFETY

When you know every detail of your facility, from the location of conveyors and lines to the anchor bolts in the floor, you can quickly answer vital questions and adapt to changing environments. You eliminate guesswork and rework in retrofitting lines, adding new equipment and ensuring quality control. Importantly, you maximize the safety of people in the plant by enabling them to access data remotely and minimize their exposure to potential hazards.

Having accurate 3D spatial data on your entire facility in a comprehensive cloud-based data library that can be accessed as needed by key stakeholders enables you to swiftly make changes and manage the entire plant from a remote location. Knowing the precise placement of existing ductwork, conduits, machinery, and equipment in your plant makes it possible to perform clash detection before new equipment is installed, which can reduce up to 95% of the amount of rework and change orders that usually occur. You can walk through the plant virtually, take snapshots, measure from images and create markups with notes and links. You can use the data in CAD packages to develop living, breathing existing-condition drawings that remain accurate as the plant changes. In short, you can turn on a dime to keep your plant responsive, productive—and safe.

As plant managers, owners and operators search for ways to minimize risks and maximize safety, digital remote management based on high-definition 3D laser scanning provides a proven solution. It's an investment that pays dividends in providing accurate, accessible, visual and actionable information both today and well into the future.