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# Wrench Time by Design

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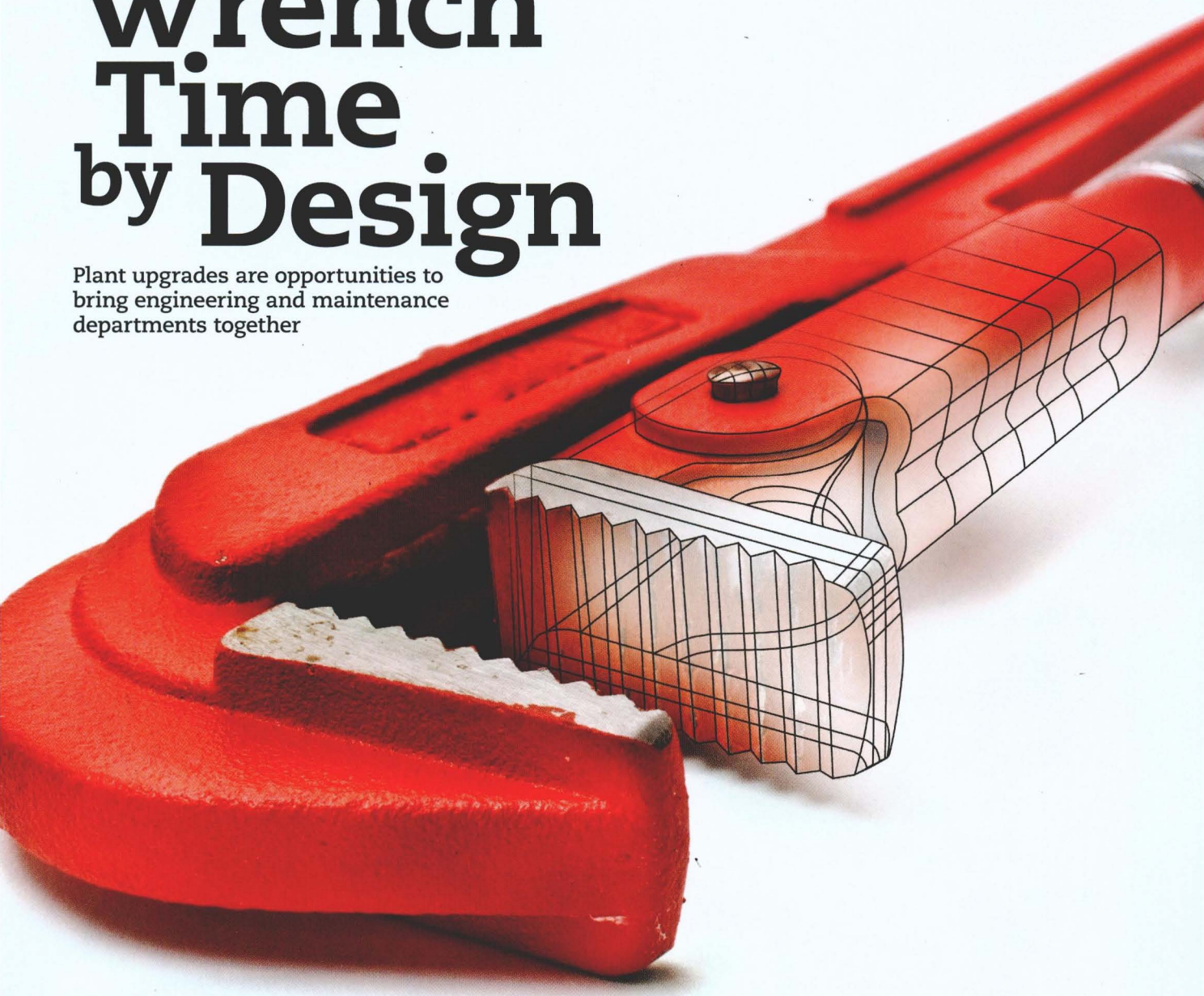

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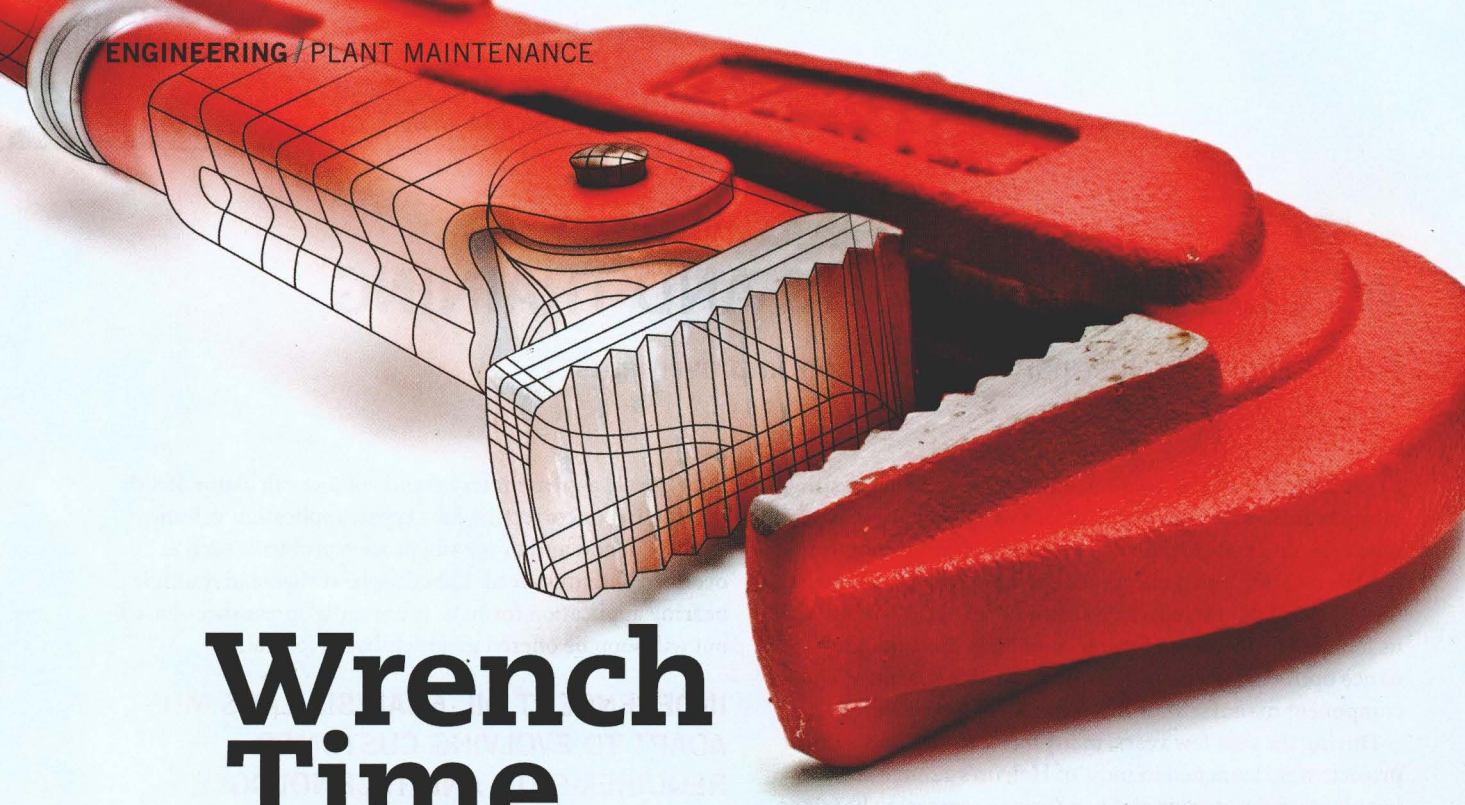

# Wrench Time by Design

**Plant upgrades are opportunities to bring engineering and maintenance departments together**

By Mike Bacidore, Editor in Chief

**Plant upgrades and** overhauls mean involving the engineering department and having the foresight to not only change what is lacking, but plan for future needs, as well. Three plants took advantage of facility modifications and parlayed them into better maintenance and reliability.

In the first example, the addition of secondary wastewater treatment necessitated an upgrade in emergency standby power, which meant installing a new system that matched the existing one. The improvement allowed the treatment plant to meet EPA standards and gave it the backup power it required in the event of an outage.

Equipment stress protection made a difference in the second example, in which a firearm manufacturer increased reliability and productivity by implementing functional interface stress hardening. Engineering, operations, and maintenance personnel's ability to work and plan together allowed the facility to mitigate equipment downtime.

Finally, when a food production plant had expanded to the point where it was unequipped to handle the breadth and volume of its products, a complete facility overhaul allowed for more efficient operations and the plant moved to a predictive maintenance strategy.

## STAND BY YOUR POWER

Built in the late 1990s, the South Bay International Wastewater Treatment plant is a joint effort between Mexico and the United States to treat sewage from Tijuana, Mexico, and eliminate environmental concerns in the Tijuana River Valley just south of San Diego. The plant is located on a 75-acre site in the United States. The International Border and Water Commission (IBWC, www.ibwc.gov), the plant's operator, needed to add secondary treatment to improve the quality of the discharge water because it was found not to meet current environmental standards set by the EPA.

The South Bay wastewater treatment plant has a capacity of 25 million gal/day. Its original design consisted of advanced primary treatment, which involved the addition of chemicals to the influent to promote removal of solids and dissolved organic compounds through settling. The treated water was then discharged via a 4.5-mile pipe extended out into the Pacific Ocean near the Mexico-California border.

Secondary treatment involves bacteria-activated sludge combined with aeration and additional settling. Encouraged by the large supply of oxygen bubbled through the sewage, aerobic bacteria consume the remaining organic compounds in the effluent. The sludge is then removed by additional settling and then recycled to reuse the bacteria. After secondary treatment, the water quality is much improved and meets EPA standards. Adding secondary treatment has greatly increased the plant's electrical load. The large aeration pumps and activated sludge system necessitated the addition of another 2,000 kW of emergency standby power, so the plant turned to MTU Onsite Energy (www.mtuonsiteenergy.com).

"The plant hasn't been expanded in terms of overall capacity," says Steve Smullen, area operations manager, IBWC. "It was originally designed for both advanced primary treatment and secondary treatment, but the secondary facilities were not immediately funded. Recently, we got the funding, and now we've added a biological system, aeration and settling facilities to meet our EPA permit requirements. As a consequence of completing the secondary treatment, we also added quite a bit of additional electrical load to the plant to operate three 700 hp aeration blowers and related equipment. In case of a utility outage, we needed the additional standby generation to handle those larger loads."

The plant wanted the new power system installation to physically match that of an existing 2,000 kW generator that was installed during the original construction in the late '90s, says Tim Oergel of W.W. Williams, the local distributor for MTU Onsite Energy. "Getting the two generators to fit into identical packages was a challenge," he says.

One design issue was that the MTU Onsite Energy unit was 16 years newer than its companion, which was from a different manufacturer. The new unit operates at 12.47 kV housed in a specially designed ISO container. This newer generator set is EPA-certified to meet Tier 2 emissions regulations, whereas the existing generator set was manufactured at the beginning of Tier requirements and was compliant with, but not EPA certified to, Tier 1 standards.

In addition to not having modern emissions control hardware, the existing generator drive engine set did not have an electronic governor or other electronic controls to help it synchronize with the new generator drive engine. To get the two generators to communicate with each other, the existing generator's governor was replaced, along with many other controls. The overhaul also included new paralleling switchgear, automatic transfer switches, and various communications interfaces.

"While the MTU Onsite Energy EPA-certified Tier 2 generator set is more fuel efficient and has significantly cleaner exhaust, it also has higher heat rejection that requires a specialized radiator," says Oergel. "Because we had to match the size of the original 40-ft ISO container, we had to be creative in designing a radiator with higher heat rejection to fit in the same-sized package as the original generator set. The solution was a specially designed radiator from R.F. Partridge & IEA Radiator that was direct-driven through a planetary gear off the engine's crank shaft. With a larger surface area and greater airflow, the special radiator was able to fit inside the container and still provide the necessary cooling."

**"AT LEAST ONCE OR TWICE A WEEK, YOU'D HEAR FROM A CNC OPERATOR THAT THE MACHINE HAD JUST STOPPED."**

The physical installation of the containers is unique, as well. Each containerized generator set is mounted on a concrete pad outside of the plant's main building. Because the plant is located in earthquake country, both generator-set containers are supported by a seismically reinforced mezzanine structure consisting of I-beams connected in crisscross patterns (Figure 1). These structures support the weight of the containers and are bolted to the concrete pad to prevent damage to the generators in the event of an earthquake.

Installation, final commissioning, and load-bank testing were completed in the summer of 2010 to make sure that both units could carry the full plant's load while operating in parallel. "Getting the different units to operate together was a challenge," says Oergel. "There were many sequence-of-operation changes that were needed to make sure both units functioned properly and could carry the load."

### TEACH A MAINTENANCE ENGINEER TO FISH

Sturm Ruger (www.ruger.com) manufactures American-made firearms for the commercial sporting market, offering more than 400 variations on more than 70 products across 25 product lines. Its main rifle and pistol components manufacturing plant in Newport, New Hampshire, is more efficient and profitable today than it was in 2007 because of a proactive maintenance department and a vice president of operations who understands the value and the necessity of reliable equipment.

In 2007, with unscheduled downtime on the automation and manufacturing controls and CNC machine tools, David Ford, the hydraulic maintenance specialist, requested a portable oil filtration system to cut down on hydraulic oil contamination, save some money on oil costs, and, hopefully, boost machine uptime.

Tom Sullivan, vice president of operations at the Newport plant, thought it was a good idea, but not all oil filter systems are equal. He asked Howard Cooper at Amemco (www.amemco.net) to prepare a plant-wide equipment survey and conduct an orientation seminar on functional interface stress hardening (FISHing). These meetings brought the maintenance and manufacturing engineers, plant management, and maintenance specialists together to hear Cooper explain how to replace preventive maintenance with condition-based maintenance (CBM) and how to maximize uptime and equipment reliability by going FISHing.

Cooper's facility and equipment survey revealed one root-cause stress to be frequent power surges and voltage transients that were affecting CNCs, PLCs, computer and electronic controls, and drive systems. The survey identified and prioritized other root-cause stresses and resulted in a machine-by-machine stress protection solutions report. This document served as a stress-hardening protection recommendation and installation guide.

Kim White, Sturm's maintenance manager, authorized Bill Ross, Sturm's maintenance electrician, to test the proposed solutions in the report. The initial testing involved installing high-speed clamping/filtering transient voltage surge suppression (TVSS) units from Total Protection Solutions (www.tpssurge.com) and air-to-air heat exchangers on two Portland reamers in the gun forge molding department.

Historically, Sturm Ruger was replacing at least one of these motion axis drives every other month and experiencing the loss of production. Since the replacement, there have been no costly axis drive replacements needed and no scrap being generated from marginal and failing axis drives.

Summer heat also was affecting the company's Technidrills and Extrom Carlson CNCs in the woodworking department. Frequently the cabinet doors were left open to keep the controls from malfunctioning or failing. The report included the size and type of control coolers to use, the proper connection points, and mounting details for the TVSS devices. The woodshop hasn't experienced downtime or quirky malfunction problems since making the changes.

Based on these pilot-test results, Sturm Ruger began implementing the FISH report suggestions across the manufacturing facility. "From the time I started with Sturm Ruger back in 2003," says Ross, "at least once or twice a week, you'd hear from a CNC operator that the machine had just stopped or wouldn't start up correctly. We'd have to shut off the main power switch feeding the machine tool and turn it back on again to reset or reboot it. That seemed to fix the problem until the next occurrence. Since completing this equipment stress protection project, I've not heard of that happening again."

The overall effect was like installing a large UPS on every machine tool, but the real savings came from increased reliability, productivity, and uninterrupted profits.

Shortly after restructuring maintenance, the concepts and methods of the original project were expanded to include additional machining and process control areas, as well as TPS suppressors to protect Sturm's low-voltage lighting.

### FOOD PRODUCTION OVERHAUL

Minnesota-based Faribault Foods (www.faribaultfoods.com) is no stranger to the importance of sustainability in food production. As a producer of many foods including a wide variety of beans, chili, organic soup, juices, and canned pasta, Faribault Foods is a member of the Sustainability Initiative Team (SIT), a part of the Foundation for Strategic Sourcing. The group is comprised of executives from major consumer packaged goods, contract manufacturing, and