

CASE STUDY

Metro Wastewater Reclamation District—Denver, Colorado

Utility-Grade Relays Protect Critical Motors at Denver-Area Wastewater Plant

To provide necessary assurance of critical blower system uptime, Metro Wastewater Reclamation District replaced aging relays with utility-grade SEL-701 Motor Protection Relays from Schweitzer Engineering Laboratories, Inc., which offered more durability, robust features, and improved availability at a lower price than conventional relays.

Denver, CO—The Denver-based Metro Wastewater Reclamation District (Metro), the largest wastewater treatment plant between the Mississippi River and West Coast, has some daunting challenges in disposing of solid waste and returning clean water to the community.

Metro's water throughput from its 380-square-mile district is 150 million gallons per day. The water it purifies contributes 90 percent of the South Platte River's annual flow at the point of discharge. Any sustained interruption of reclamation processes could therefore have a devastating impact on this vital natural resource.

Metro not only treats, but also markets the solid wastes removed from the water it collects from 256 miles of interceptor sewers. Anaerobically treated biosolids extracted from the water are used to improve soil and to enrich agricultural lands. Metro facilities produce 74 dry tons of biosolids daily and apply them to 50,000 acres of district-owned land near Deer Trail, Colorado, and on privately owned land in northeastern Colorado.



Figure 1—NEI Electric Power Engineering first introduced Metro Wastewater Reclamation District to SEL products in the cogeneration section (shown above) of the Metro plant. The anaerobic digestion process used to produce biosolids also produces methane, which was used to fuel four large electrical generators and heat the ten anaerobic digesters as well as provide electrical power and heat to other buildings on the plant site. Most of the electrical power was sold to Public Service of Colorado, generating about \$1.6 million in revenues per year. When that contract expired, two new, more efficient gas turbine units were installed.

Metro also markets a line of Metro-grow™ compost and other fertilizers that are beneficial to soils and plants, not only for landscapes and gardens, but also for reclamation of such areas as mine tailings and overgrazed rangeland.

As far as the water itself is concerned, more than 95 percent of pollutants are removed, making treated water suitable for agriculture, aquatic life, household water supply, and recreation. Just eight

to ten hours are needed to treat wastewater from the time it enters the plant until it is discharged into the South Platte River.

Metro's efficiencies and quality have won recognition from the EPA. Its systems and standards are continually updated and supported by elaborate monitoring and backup equipment. Of course, with its huge throughput, it is critical to Metro's dependent customers and environment that water processing continue with virtually no interruptions.

"From a practical standpoint, most equipment service is an emergency at a facility such as Metro," said Andy Leoni, manager of engineering at NEI Electric Power Engineering, which engineers the design and service of Metro's electrical and communications systems. "While there is backup equipment for key motors, when a motor is brought offline, you have to service it right away. Otherwise, if the backup fails, the process it powers could be out of business."

Leoni explained that wastewater plants are inherently harsh environments for electronic equipment due to the presence of hydrogen sulfide and dust in the air. "Hydrogen sulfide causes corrosion in power system materials such as copper and silver-plated copper, and this type of corrosion is very hostile to protective relays and electronic controls."

For several years, NEI studied and redesigned the entire Metro power system. Of specific concern were the electric motor protection relays that safeguarded the motors powering several 15 kV and 5 kV aeration blowers.

"The usual industrial-grade relays that were already in use didn't provide the

reliability or security we wanted," Leoni said. "Inconsistent performance and lack of product support were causing a great deal of coordination problems and occasional equipment failures, including relay and control-logic failures. When one or more blower motors quit, part of Metro's treatment capacity would be temporarily disabled. Worse yet, if such an event were to go undetected, EPA violations could occur, a situation that Metro was determined to prevent."

Another worry was the fact that the industrial-grade relays Metro had used were expensive to replace and required long lead-times for delivery.

A utility-grade solution

Dissatisfied with the idea of replacing worn or failed relays with similar equipment, NEI began to look for more rugged relays to protect the Metro aeration blower motors in mid-1999. The relays they selected were from Schweitzer Engineering Laboratories, Inc. (SEL) of Pullman, Washington, well established in the utility industry for manufacturing very durable and robust products.

"We had been using SEL relays extensively with our utility and industrial customers," Leoni said. "Metro's engineers and maintenance personnel were very satisfied with the previous retrofits at their plant, and it took little convincing to adopt SEL products as the standard for medium-voltage protection applications. However, during the initial design stages, SEL did not have a motor protection relay possessing the features most industrial users desire."

Consultation with Walt Slade of K D Johnson, the SEL sales representative, confirmed that SEL had a robust product

in development that would meet Metro’s present and future needs, the SEL-701 Motor Protection Relay. The SEL-701 offered not only complete protection features, but also an impressive range of communications, monitoring, and metering capabilities.

“Prior to the introduction of the SEL-701, we were considering motor protection relays other than those manufactured by SEL,” Leoni said. “Once the SEL-701 was introduced and we had a chance to evaluate it, we were impressed enough to recommend it as the standard for Metro.” Metro’s project manager and electrical engineer, Jean Larsen, concurred with the recommendation, and the SEL-701 was incorporated into the system design.

While completing the plant design, one of the preexisting industrial-grade relays failed. Metro’s maintenance supervisor, Jim Carabajal, and maintenance planner, Larry Dulworth, contacted NEI in dire need.

“We had contacted the manufacturer of the failed relay (the second failure in about ten years). The price and delivery seemed outrageous, so we asked Andy if we could use a retrofit SEL-701 instead,” Dulworth said. “Amazingly, this utility-grade device was not only more durable and robust than the industrial-grade counterpart, but it was also less expensive and required much less lead-time for delivery.”

Among the SEL-701’s many sophisticated features Metro uses is the Sequential Events Recorder (SER) to report faults and act as an analytical tool as well as its integral metering and easy-to-use communications functions.



Figure 2—To provide necessary assurance of critical blower system uptime, Metro Wastewater replaced its aging motor protection relays with utility-grade SEL-701 Relays, which offered more durability, robust features, and improved availability at a lower price than conventional relays.

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As with the old system, the new gas turbines had to meet Public Service’s system interconnect requirements, which was accomplished with the SEL-351 Directional Overcurrent and Reclosing Relay and the SEL-300G Generator Relay. The SEL-351 units were connected via a SEL-2030 Communica-

tions Processor to the existing distributed control system.

NEI's redesign of Metro systems places some emphasis on system integration, automation, and communications. A fiber-optic network was installed to connect all the SEL-2030s and their associated relays to Metro's distributed control system. SEL equipment is now standard on all medium-voltage equipment throughout the wastewater treatment operation. NEI and Metro have installed eight SEL-701 Relays, six SEL-2030s, two SEL-587 Current Differential Relays, two SEL-501 Dual Universal Overcurrent Relays, two SEL-300Gs, and approximately 35 SEL-351 Relays.

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About NEI Electric Power Engineering

NEI is a consulting business located in Wheat Ridge, Colorado. Founded in 1982, NEI provides state-of-the-art service and expertise to regional electric utilities, co-ops, municipal utilities, investor-owned electric utilities, large chemical and process plants, privately owned power producers, heavy industry,

commercial facilities, and many others. NEI provides professional expertise and design engineering services for all aspects of power system engineering. NEI is a true specialist in the field, able to take projects—large or small—from concept to implementation. For more information, contact NEI Manager of Engineering Andy Leoni, phone: (303) 431-7895; fax: (303) 431-1836; email: aleoni@neiengineering.com; website: www.neiengineering.com.

About SEL

Schweitzer Engineering Laboratories, Inc. (SEL) has been making electric power safer, more reliable, and more economical since 1984. This ISO 9001:2000-certified company serves the electric power industry worldwide through the design, manufacture, supply, and support of products and services for power system protection, control, and monitoring. For more information, contact SEL, 2350 NE Hopkins Court, Pullman, WA 99163-5603; phone: (509) 332-1890; fax: (509) 332-7990; email: info@selinc.com; website: www.selinc.com.

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