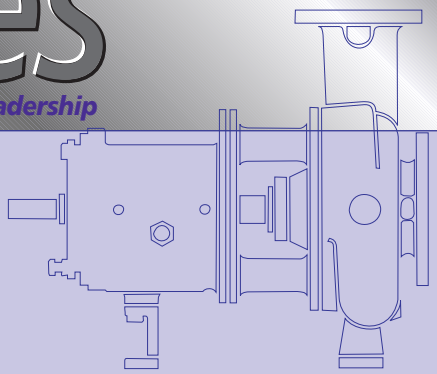
PumpLines
Innovation...Technology...Leadership
SUMMER 2003



Mississippi Power Lowers Maintenance and Energy Costs with PumpSmart

When the Mississippi Power Company added two combined cycle 525-megawatt units to an existing 1000- megawatt coal fired plant, pump seal failure at the plant's water treatment facility put the production of electricity in jeopardy. Replacing the original pumps with Goulds 3355 pumps equipped with the PumpSmart® control system has eliminated repetitive seal failures, while reducing maintenance, downtime, and pump energy consumption.

Formed in 1925, Mississippi Power Company is an investor-owned electric utility serving 192,000 customers in 23 counties in southeast Mississippi. In the mid-1990s, The Southern Company, the parent company of Mississippi Power, projected it would need to add new generating power in the near future to serve its customers, especially during peak power periods.

To meet the projected demand, plans were implemented for the installation of two combined cycle units at an existing coal burning facility, Plant Daniel. Combined cycle technology is one of today's most cost-effective generation available and can be built in a relatively short lead-time. A combined cycle power plant takes wasted heat from simple cycle combustion turbines, and runs this heat through a boiler to create steam. This steam is then used to create even more energy.

The Mississippi Power Company Daniel Plant.

Mississippi Power installed two 525 megawatt combined cycles at Daniel. Each combined cycle is comprised of two single cycle combustion turbines each with a generator. The wasted heat from each combustion turbine travels through its own boiler. The steam generated from the two boilers is then used to turn a third generator. This type of combined cycle is referred to as "two on one."

During peak periods additional natural gas burners are inserted into the boilers to make more steam. This excess steam is removed from the main steam line and diverted to each combustion turbine, a process called power augmentation. Power augmentation is used to supplement the loss of total mass flow rate during hotter weather. As ambient temperature rises, the density of air decreases. Therefore, excess steam supplements the combustion air to regain the loss of mass flow rate.

The steam used for this process is inserted directly into the combustion process and then the stack, which requires additional water to be pumped into the system. To fully utilize power augmentation, Plant Daniel needed to upgrade its water treatment facility to produce the increased amount of water needed.

In order to maximize the life of the boiler tubes, water goes through four treatment phases to yield the necessary purity. First, the water is chlorinated to kill bacteria and algae. Next, it is sent through an ultrafilter to remove silt and other fine particles from the water. Reverse osmosis (RO) is then used to further purify the water and, finally, the water is demineralized to remove all remaining impurities or minerals. By the end of the process, the demineralized water is so pure that impurities are measured in parts per billion.

Pump Failing in Reverse Osmosis System

The new water treatment plant included 4 skid-mounted RO units, each capable of producing up to 220 gallons of water per minute. A submersible turbine pump drives each skid. These pumps, lying horizontally inside a pipe, were performing unreliably. As explained by Jerrod Hunt, a plant engineer with Mississippi Power, "Basically you had a submersible

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IN THIS ISSUE:

The last issue of Pumplines has been revised and the pdf file has been uploaded to the website. The Tech Talk article "Patented Technology Future Foundation for Control Solutions" was inadvertently cut off.

View this issue and previous issues of ***PumpLines*** *on our website at* ***www.gouldspumps.com***

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Mississippi Power...

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pump in a horizontal application. The pump was designed with a flooded suction to prevent cavitation. The motor and the pump itself were both in the same housing, with the motor sitting in glycerin. Pump seal failure ultimately led to catastrophic pump failure."

When a pump failed, it had the potential to reduce the plant's generating output, possibly by as much as 25 to 30 megawatts at peak power times. When a failure occurred, noted Hunt, "We would have to significantly shorten the times that we could utilize power augmentation, and we sometimes augment for 10 hours each day during peak season."

Mississippi Power had experienced three pump failures during the first year of operation, even though the pumps were not being run constantly — only during the four or five month peaking periods during the summer. In addition to the lost generating capacity, the failures created costly repair bills.

"After the first pump failure, we sent it out for repair," Hunt remembers. "One estimate for repair was only $400 less than it was to buy a new one. The pumps were extremely difficult to work on and had to be totally dismantled to fix the seal. The motor would also have to be replaced on some of the seal failures because lead-time to repair the damaged motor was too long."

Reliable Solution Sought

Mississippi Power needed to find a reliable solution for these frequent pump failures before the 2002 peak energy season, which runs from May through August. The company contacted Brownlee-Morrow Engineering Company, a Goulds Pumps distributor, and sent them the required flow curves.

"Originally we were going to go with a single stage, but we couldn't get the desired pump performance needed for reverse osmosis," Hunt recalls. "That's when Brownlee – Morrow came up with the multi-stage centrifugal design." Chris Jones, a Brownlee-Morrow sales engineer, suggested the Goulds 3355 MultiStage Pump with a PumpSmart® control system as the solution and Mississippi Power ordered one to start out with. "The Model 3355 is an end suction, low profile industrial pump with various porting options," Jones says. "With the Goulds 3355, Mississippi Power could remove a portion of pipe and fit the pump right into the system. This allowed them to do a retrofit instead of a new installation because it was able to be done in the same footprint."

The Goulds PumpSmart control system is a pumping system that uses a standard

Chris Jones of Brownlee Morrow Engineering points to Goulds 3355 multistage RO pump.

centrifugal pump in conjunction with a "smart controller" and proprietary pump control software. The software, which resides on the controller microprocessor chip, is the "brains" of the system, allowing the pump to monitor and react to any system condition.

Significant Savings with PumpSmart

In the original system, old style can pumps operated with a soft start controller and a control valve to maintain a constant flow. "It is like driving at top speed on the interstate and using the brake to regulate your speed," Jones says. "The original pump would be at full RPM and this valve would adjust to make sure that the flow stayed constant." Installing the PumpSmart control systems on the pump allowed for the elimination of the throttling valve. PumpSmart also eliminated the need for a soft start with the ability to ramp up slowly.

"One problem was that the transformer, which supplied the water treatment plant, was already at max capacity and the Goulds pump was a 100 horsepower unit, up from the current 75 horsepower unit," said Jones. "When you first start up a pump, there is a large rush of current and the transformer didn't have the capacity to support that load. What the PumpSmart does is to provide a soft start for the pumps, bringing them up slowly so that there is not a large in rush of current."

While Mississippi Power waited for the first Goulds pump to be delivered, another of the original pumps failed. Then, a third pump began to have problems caused by water traveling up to the conduit and shorting the motor and controls out. At that point, Mississippi Power decided to replace all four pumps.

The first PumpSmart equipped pumps have been in operation since March, 2002. The remaining pumps in the RO facility were installed three months later. The maintenance record so far has been excellent, with no major pump failures. According to Jones, one of most important issues is that the pumps can be maintained in the customer's own shop. "Plant Daniel's mechanics

PumpSmart intelligent control system panels.

can handle the re-work of these units with ease as opposed to the horizontal style pumps which lead to a major expense with each breakdown."

With reverse osmosis, the pumps are required to push the raw water through a great deal of filtration media. A slight change in water temperature can change the required discharge pressure by more than 100 psig. The normal design for an RO system is to design for a winter condition and then throttle all other conditions to maintain this point. The statistics on energy consumption show that the PumpSmart equipped Goulds pumps ramp up to about 44% of power during peak months. Even though the motor size is rated at 100 HP instead of the 75 HP on the original pumps, the RPM's are much slower - running at 2000 rpm instead of 3600 - **saving approximately 75% on energy** requirements. Jones projects there will be a four-year pay back period based on power consumption alone.

Running Quietly

The Goulds pumps also solved a major sound issue. Hunt remembers that the original pumps in the powerhouse building were so loud that they prevented verbal communication. "The new Goulds pumps are operating so much more quietly than the original pumps that plant employees mistakenly thought they were not working at all," he says. "That's been an unexpected, ear-saving benefit."