Custom Design & Fabrication of Condenser Tube Cleaning System for Dominion Power

Introduction
Dominion Power is one of the United States’ largest producers and transporters of energy, with a portfolio of approximately 25,700 megawatts of generation and 6,500 miles of electric transmission lines. Dominion serves more than 5 million utility and retail energy customers in 14 states.

Dominion’s Mount Storm Power Station is the largest coal-fired power station managed by Dominion Resources. Its 3 units can generate nearly 1,600 megawatts of electricity – as much in one hour as 160 average homes use in one year. Despite excellent operating processes, during the summer months Mt. Storm’s turbines can lose 2-4% of output capacity (20-40 MW) due to condenser tube fouling. Dominion expressed interest in evaluating possible replacements or upgrades to existing tube cleaning systems in order to recover this lost power generation capacity.

In 2015, Dominion contracted Innovas Technologies to provide optimized performance over a competitor’s existing automatic tube cleaning system on Mt Storm Unit 3B Condenser, and to expand the tube cleaning system from treating one condenser to two condensers. The existing competitor’s ball trap had demonstrated exceptionally high operating pressure drop and a propensity to pin sponge cleaning balls inside it.

The overall goals of the project were to:
- Reduce operating pressure drop across ball trap
- Improve sponge cleaning ball return rates
- Reduce overall physical footprint of the ball trap
- Expand the automatic tube cleaning system capability to treat two condensers rather than one
- Demonstrate reliable & effective tube cleaning system performance for further deployment

For the project, Innovas Technologies employed “Best Practice” engineering techniques to develop custom ball trap designs and completed performance testing on a 1/6 scale model of the competitor’s 36” ball trap and custom Innovas ball trap designs. Innovas then performed detailed design and fabrication of two 36” diameter ball traps utilizing the optimal ball trap configuration.

Additionally, Innovas designed and fabricated the necessary piping and PLC digital control systems to expand the tube cleaning system to provide tube fouling prevention for two condensers.

Hydraulic Modeling, Testing, and Optimization
As an essential element of design validation, hydraulic modeling and testing was conducted at the University of Iowa Hydraulic Laboratory (IIHR) in...
Innovas successfully recreated the field performance of the competitor’s existing ball trap, both in terms of clean ball trap pressure drop and in ball return rates. Innovas was also successful in designing a ball trap alternative that provides vastly superior performance in both the clean ball trap pressure drop and ball return rate parameters, as demonstrated in the charts below.

### Innovas Ball Traps Demonstrated Significantly Improved Pressure Drop

The competitor’s existing as-built ball trap exhibited the highest clean ball trap pressure drop at all three fluid velocities. At higher fluid velocity (~10 ft/s) the clean ball trap pressure drop became excessive (>7.5 psi) and would negatively impact cooling water pumping system performance. The existing as-built design also pinned significant numbers of cleaning balls in several areas, which caused the pressure drop across the ball trap to further increase.

Innovas Technologies Develops Custom Design Options for Testing

The Innovas Option 1 ball trap design exhibited good clean ball trap pressure drop across the full range of fluid velocities, with pressure losses lower than published pressure drops for typical industrial y-strainers. The Option 1 design also returned all cleaning balls on collection, with no pinning across the fluid velocity range.

The Innovas Option 2 ball trap design exhibited the lowest clean ball trap pressure drop at all three fluid velocities. However, the Option 2 design also demonstrated the lowest rate of cleaning balls return on collection, with cleaning balls pinning at both the 7 ft/s and 10 ft/s fluid velocities.

With excellent test results in hand, Innovas initiated detailed design of the Option 1 ball trap in the full-scale 36” diameter version for Mt. Storm power station.

### Custom Design and Fabrication of 36” Nominal Diameter Ball Traps

The Innovas Option 1 design demonstrated superior performance in terms of pressure drop and cleaning ball retention and return rates, and did so in a more compact physical package. Innovas initiated detailed design utilizing 3D CAD tools to turn the test concept into full-size production equipment.

### Innovas equipment is manufactured in a state-of-the-art fabrication facility.

www.innovastecnologies.com
Fabrication of the ball traps and equipment was performed by ASME certified welders and subjected to verification in accordance with the ASME B31.1 Power Piping Code and Innovas’ ISO9001 Certified Quality Management System.

The fabrication of ball traps and associated equipment, including internal and external anti-corrosion coatings, was completed in six weeks and the equipment was shipped ahead of schedule.

Installation & Operation
The installation configuration of the existing condensers required that the two 36” ball traps be installed in a very tight location, with a concrete mezzanine overhead and butterfly valve for isolation immediately downstream of the traps. By all accounts the installation and fit-up process for Innovas-provided equipment was smooth and straightforward due to precise fabrication tolerances and quality control.

Innovas commissioned the tube cleaning systems and field results matched precisely with the hydraulic laboratory performance results—all cleaning balls were returned without pinning, and a pressure drop of well under 1 psi was measured across the ball traps.

Innovas vs. Competition
The competitor’s old ball trap was inspected in the site’s equipment graveyard after removal. Even in a quick visual inspection of the traps the advantages of the Innovas ball trap design are readily apparent. In the competitor’s ball trap extensive areas of the main pipeline were blocked off with solid plates in order to get the cleaning balls routed to the ball exit. The Innovas design achieves perfect ball return rates
without occluding the open area for flow in the main pipeline.

The Path Forward

The optimized condenser tube cleaning system has been well received at the Mt. Storm facility, with excellent reliability and system performance.

The next level of performance achievement will require use of Innovas’ patent-pending design in retrofitting the site’s 108” and 120” nominal diameter condenser piping systems to improve power generation output.

INNOVAS AT A GLANCE

Innovas Technologies offers automatic chiller and condenser tube cleaning systems. These systems work to prevent tube microfouling and scaling, and dramatically improve chiller efficiency and industrial cooling process performance. You’ll save energy, reduce maintenance, and extend the life of your capital equipment — making them your best value.

See the Helios TCS™ in Video:

http://www.youtube.com/watch?v=7kHTs-emQ_o

Contact Us

Innovas Technologies LLC
Technology Innovation Center
2261 Crosspark Rd Suite 31
Coralville IA 52241

Call Toll Free: (877) 897-6564
Email: info@innovastechnologies.com