Ingenero Solves Pipe Failures in Mixed Bed Polishers Using AFT Impulse™

Mixed Bed Polisher Water Treatment
Chemical & Petrochemical

AFT
Applied Flow Technology

Ingenero Technologies
Mumbai, India
Platinum Pipe Award Honorable Mention - Operational Benefits and Sustainability

Ingenero Technologies' Swapnil Paingankar, Specialist-Mathematical Modeling, and Dhiresh Mahajan, Assistant General Manager of Special Projects, oversaw the analysis and remediation of a client's existing resin mixed bed polishers (MBPs) in a petrochemical facility.

MBP's are used to treat condensate and demineralized water for boiler feed water systems.

In total, nine MBPs needed to be fully operational, and at any given time two were experiencing a failure of the middle collector due to severe physical damage such as bending and breaking. Their client was concerned about the continuous repair costs and the lost production time.

> "Being a pressure based transient flow modeling tool, AFT Impulse helped us understand the magnitude of an unknown force and specifically pinpoint which particular step was responsible for the highest magnitude."

Ingenero was asked to analyze and suggest possible fixes to reduce the middle collector failure. One MBP, which was reported to have the most frequent middle collector failure, was chosen for the analysis. The team analyzed the regeneration operation by incorporating the sequences used to open and close the butterfly valves in the piping system associated with the failing MBPs. (See Figure 1)

After examining the regeneration operation, Paingankar and Mahajan knew there was a force which caused the middle collector piping element to fail. They suspected the failure was due to a possible pressure surge in the MBP middle collector.

The resin bed sections above and below the middle collector were modeled as two separate pressure reducing stations. The characteristic friction factor for these packed resin sections was calculated from the operating data of flow and pressure drop under normal operation.

After simulating transient scenarios based on various valve closures/openings and field observations, it was evident the middle collector was experiencing a pressure surge as high as 104 psi, or 7 bar, during certain step changes.

Based on this surge, three additional scenarios were simulated and allowed Ingenero to confidently suggest improvements in the regeneration sequence to minimize failures. One recommendation reduced the potential pressure surge to 37 psi, or 2.6 bar (see Figure 2).

AFT Impulse helped Paingankar and Mahajan understand the magnitude of this force and specifically pinpointed which step was responsible for the highest magnitude. It also helped them carry out sensitivity analysis with respect to modifying the valve "open-close" sequence timings and evaluate whether reduction in the magnitude of the surge pressure was possible.

This project was awarded to Ingenero Technologies as a challenge to their repertoire of high end expertise of system root cause analysis. The status today is that the problem is eliminated.

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A globally recognized provider of high-end specialized engineering and process engineering services, Ingenero provides continuous remote monitoring and operations guidance for the processing industry. Ingenero's main offices are in Houston, USA and Mumbai, India. A combination of a dedicated industry skilled teams with cutting edge technical tools and expertise along with state-of-art software enables Ingenero to provide continual support to client's customized goals.

Regeneration Water
Source Tank & Pump

Mixed Bed Polisher Top

Neutralization
Pond

Mixed Bed Middle Collector
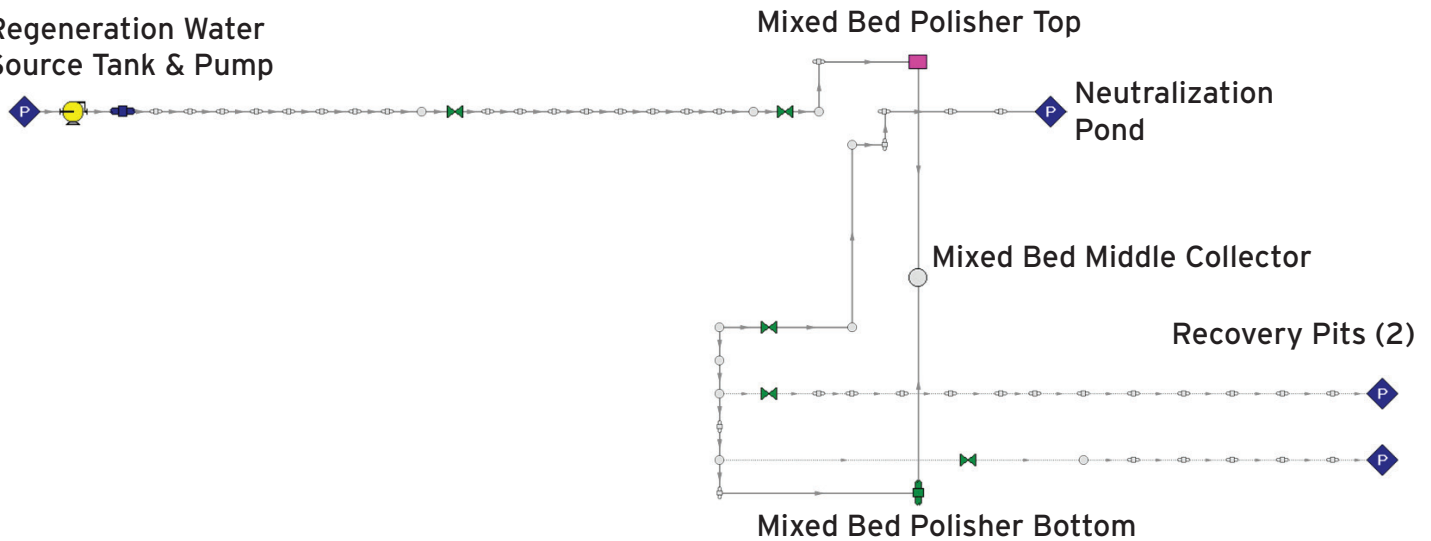
Recovery Pits (2)

Mixed Bed Polisher Bottom

Figure 1 - AFT Impulse model showing the Mixed Bed Polisher system Ingenero was asked to analyze and successfully modified utilizing innovative sequence modifications.

With AFT Impulse, Ingenero Technologies was able to successfully recommend sequence modifications to their client.

"These MBP failures were looked at by the client's in-house technical and engineering departments as well as a few globally reputed consulting organizations over 5 to 6 years without incremental improvement of the situation, let alone complete success"

Surge was initially
104 psi (or 7 bar)
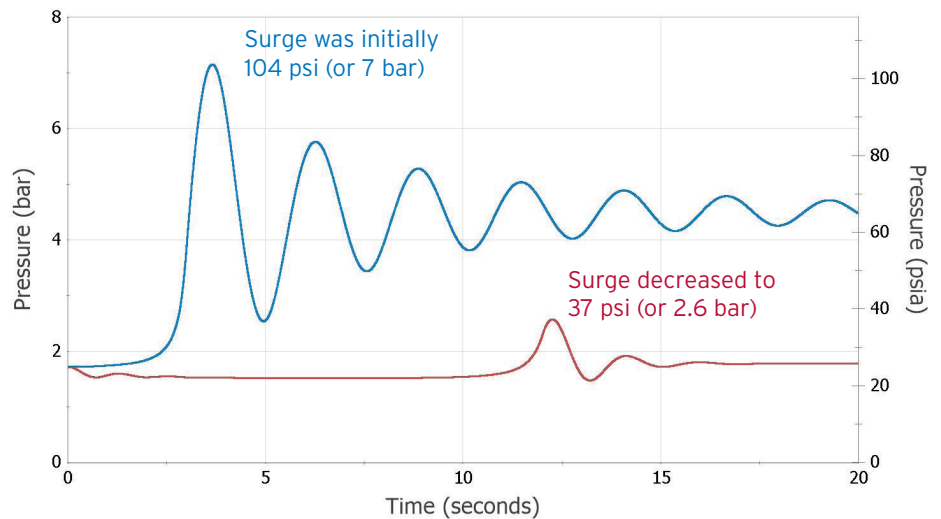
Surge decreased to
37 psi (or 2.6 bar)

Figure 2 - Ingenero Technologies utilized AFT Impulse to predict the pressure surge in the MBP middle collector before and after operational change.