FCC Catalyst Withdrawal

Almost all FCC units withdraw catalyst manually which usually takes place once every few days. There are obvious disadvantages to this batch withdrawal process. Existing designs are limited by:

- Poor control of withdrawal rate due to manual adjustments of catalyst and carrier air flows.
- Operator safety and withdrawal piping integrity due to high temperatures and poor velocity control which can result in hot catalyst spills and frequent maintenance requirements.
- Lack of cooling of the withdrawn catalyst prior to removal from the refinery.
- The sudden drop in regenerator level can have significant impact on unit operation and flue gas emissions.

Johnson Matthey has developed a novel approach which overcomes all the major drawbacks of existing designs!

- Pressure balance design eliminates erosion of throttling device normally used to control withdrawal rate.
- Pipe erosion is minimized as withdrawal line velocity is tightly controlled.
- Continuous withdrawal eliminates the large changes in the regenerator or reactor bed level seen with batch withdrawals. A constant bed level can be maintained at all times.
- Withdrawn catalyst is cooled sufficiently to prevent damage to storage vessels and improve operator safety.

CASE STUDY:

Enhancing FCC Reliability with JM's Continuous Catalyst Withdrawal System

Background and Challenges

A leading European refinery operates a Fluid Catalytic Cracking (FCC) unit with a substantial circulating catalyst inventory. Over time, the refiney's FCC catalyst withdrawal system had been compromised, creating a reliability concern. The primary withdrawal line had been decommissioned, and the backup line was clamped, creating a significant operational and safety vulnerability.

To mitigate risk, the refinery implemented rigorous risk assessments for each withdrawal event. However, this workaround constrained operations and posed a potential threat to both safety and economic performance.

In addition to this, catalyst additions to the unit were minimised to avoid regenerator level build up, leading to lower Ecat activity, hence lower unit conversion. This also had the effect of lower regenerator temperatures, which can affect the carbon burning kinetics within the regenerator.

JMs Tailored Solution

JM proposed its Continuous Catalyst Withdrawal System, initiating the engagement with:

- A comprehensive FCC plot space survey to assess installation feasibility
- A technical and commercial proposal, tailored to the site's specific constraints and objectives

JM demonstrated flexibility in adapting the system's design and configuration to align with the refinery's operational, spatial and budget requirements.

Collaborative Engineering Approach

JM partnered with the refinery's engineering contractor to deliver a fully integrated engineering package. This collaborative approach ensured:

- Seamless interface management within the broader engineering design
- Early visibility of the system design, enabling informed decision-making prior to full CAPEX approval
- Evaluation of alternative options, including a like-for-like replacement of the existing system

Project Execution & Delivery

Following Final Investment Decision (FID), the project timeline was accelerated to align with the refinery's turnaround schedule. JM responded with agility by:

- Leveraging manufacturing capabilities in Savannah (USA) and India
- Conducting a fully witnessed Factory Acceptance Test (FAT) using actual catalyst to validate system performance and control logic prior to shipment

On-Site Commissioning & Support

Upon delivery, JM's Field Service Team provided comprehensive on-site support, including:

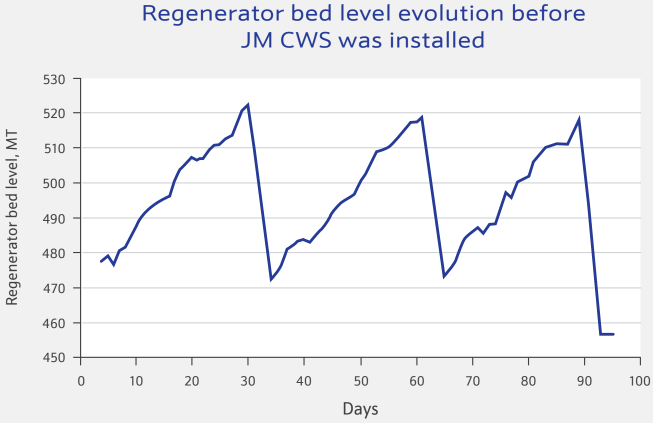
- System commissioning
- Start-up assistance
- Operator training

Additionally, JM maintains regular remote engagement to ensure continued operational success.

Results and Impact

Since installation, the JM Continuous Catalyst Withdrawal System has operated reliably, delivering measurable improvements in safety, efficiency, and operational flexibility. Key outcomes include:

- Restored catalyst withdrawal capability
- Improved Ecat activity and unit conversion
- Stabilized regenerator conditions
- Enhanced operational safety and reduced risk exposure



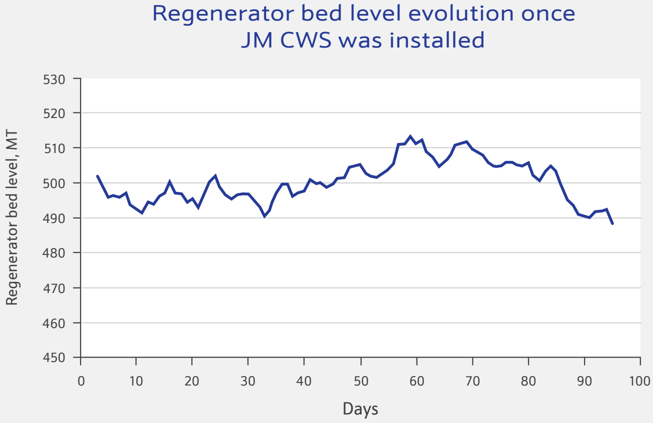


Figure 1: Regenerator bed level evolution before JM CWS was installed (batchwise bulk catalyst withdrawal) and after JM CWS was installed (continious catalyst withdrawal)

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