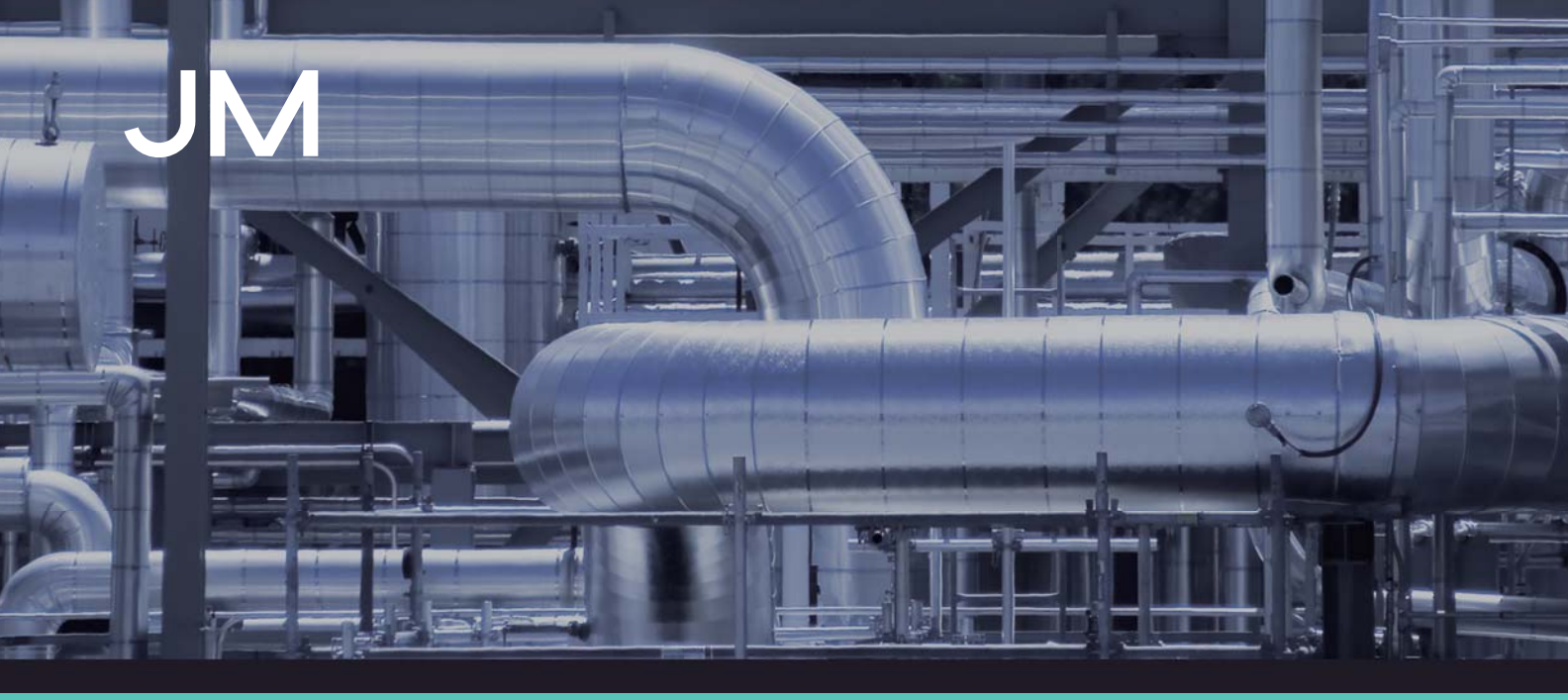

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A novel approach to FCC catalyst withdrawals

Johnson Matthey
Inspiring science, enhancing life

A novel approach to FCC catalyst withdrawals

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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- Lack of cooling of the withdrawn catalyst prior to removal from the refinery.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 "batch withdrawal process" 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- Withdrawn catalyst is cooled sufficiently to prevent damage to storage vessels and improve operator safety.

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The first Johnson Matthey **INTERCAT**™ continuous Catalyst Withdrawal System (CWS) which was installed at Marathon Petroleum Company's Garyville, LA refinery is comprised of an Everlasting isolation valve, a positive displacement fan, three finned pipe-in-pipe heat exchangers to cool the catalyst, and a collection vessel to receive the cooled catalyst. The CWS uses a sophisticated control logic to carefully control the withdrawal velocities by using pressure balance between the regenerator and the collection vessel. The collection vessel is mounted on load cells so the exact quantity of catalyst withdrawn is known. This improves the accuracy of the FCCU catalyst balance, and catalyst loss troubleshooting is made far easier. The cooled catalyst is transferred to the equilibrium catalyst (E-Cat) storage hopper prior to removal from the site.

An overview of the first installation of the CWS at Marathon Petroleum Company's Garyville, LA Refinery is shown in Image 1.

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Image1. Continuous Catalyst Withdrawal (Mark-I) Installation – Marathon Petroleum Refinery, Garyville, LA

Cooling Skid

The CWS can be carefully monitored and controlled through the refinery Distributed Control System (DCS), giving the operation maximum visibility and flexibility or alternatively can be operated through the stand alone controller provided with the system.

The Catalyst Withdrawal System can be operated over a wide range of withdrawal rates with smooth transitions when the desired withdrawal rate changes. This is dictated by the pressure balance between the collection vessel and the regenerator.

Chart 1 gives an overview of the varying withdrawal rates achieved by the CWS during testing where the withdrawal rate ranged between 1.5 tons/day and 20 tons/day.

The design capacity of the Catalyst Withdrawal System can be tailored to a refinery's particular needs and can achieve sustainable continuous withdrawals in excess of 40 tons/ day.

The conventional method of batch wise catalyst withdrawals not only gives rise to potential safety concerns, it additionally upsets the regenerator stability and affects the combustion kinetics. This unsteady period of operation can upset the heat balance and cause a degradation of yields which results in an economic loss. It also results in a change in regenerator flue gas composition as the combustion kinetics are altered. Johnson Matthey's **INTERCAT** Catalyst Withdrawal System is a fresh approach to regulate catalyst withdrawals which is one of the least controlled aspects of FCC operation.

The improved control of the catalyst withdrawals will reduce cost associated with maintenance repairs, safety incidents and operational swings in the FCC from the sudden catalyst inventory reduction.

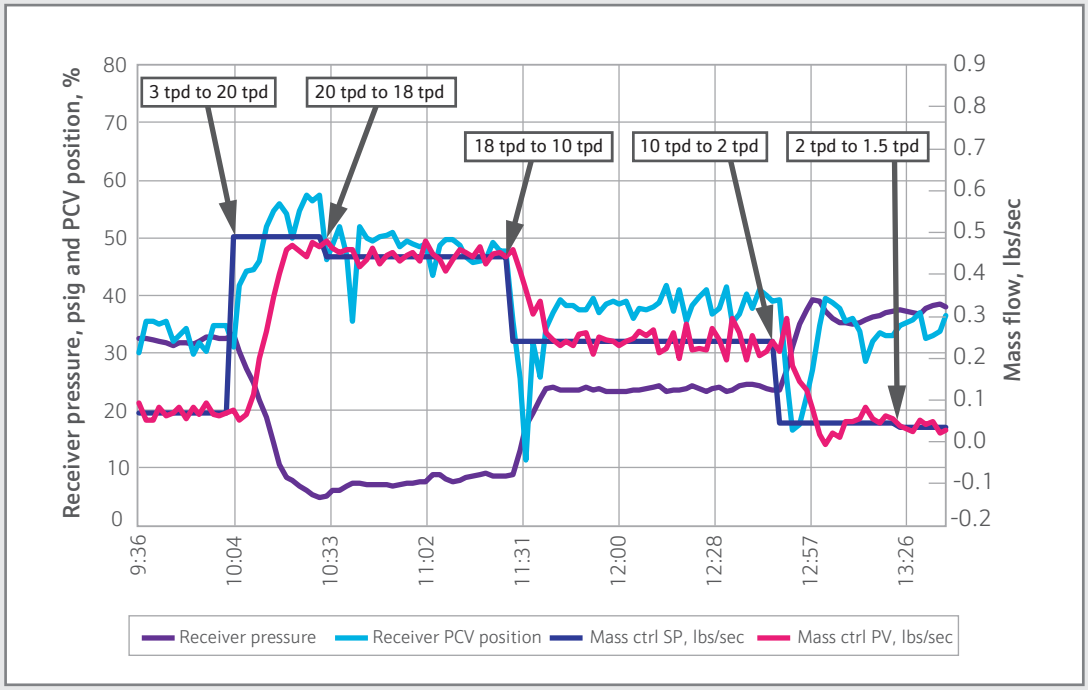
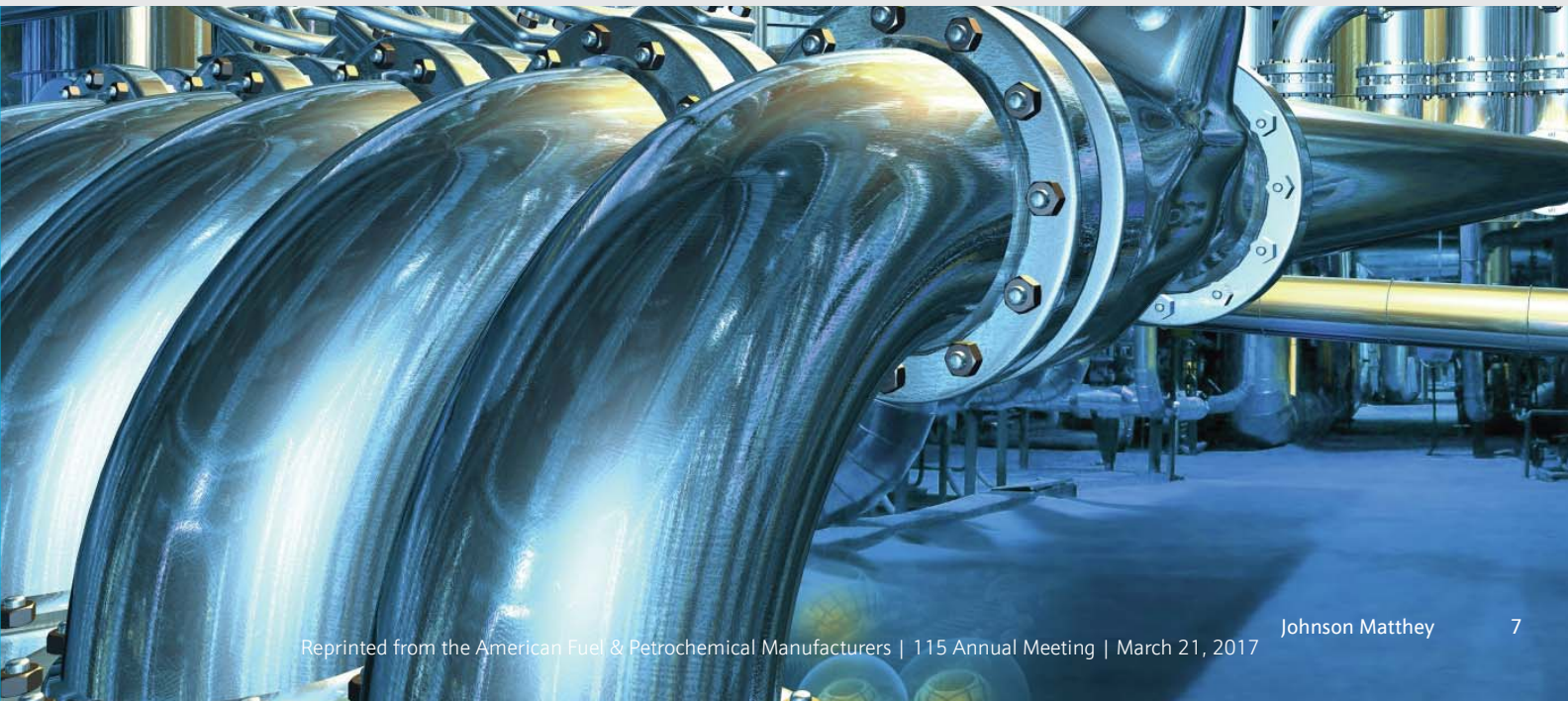


Chart 1. CWS Test Period (Withdrawal Rate Variation)



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