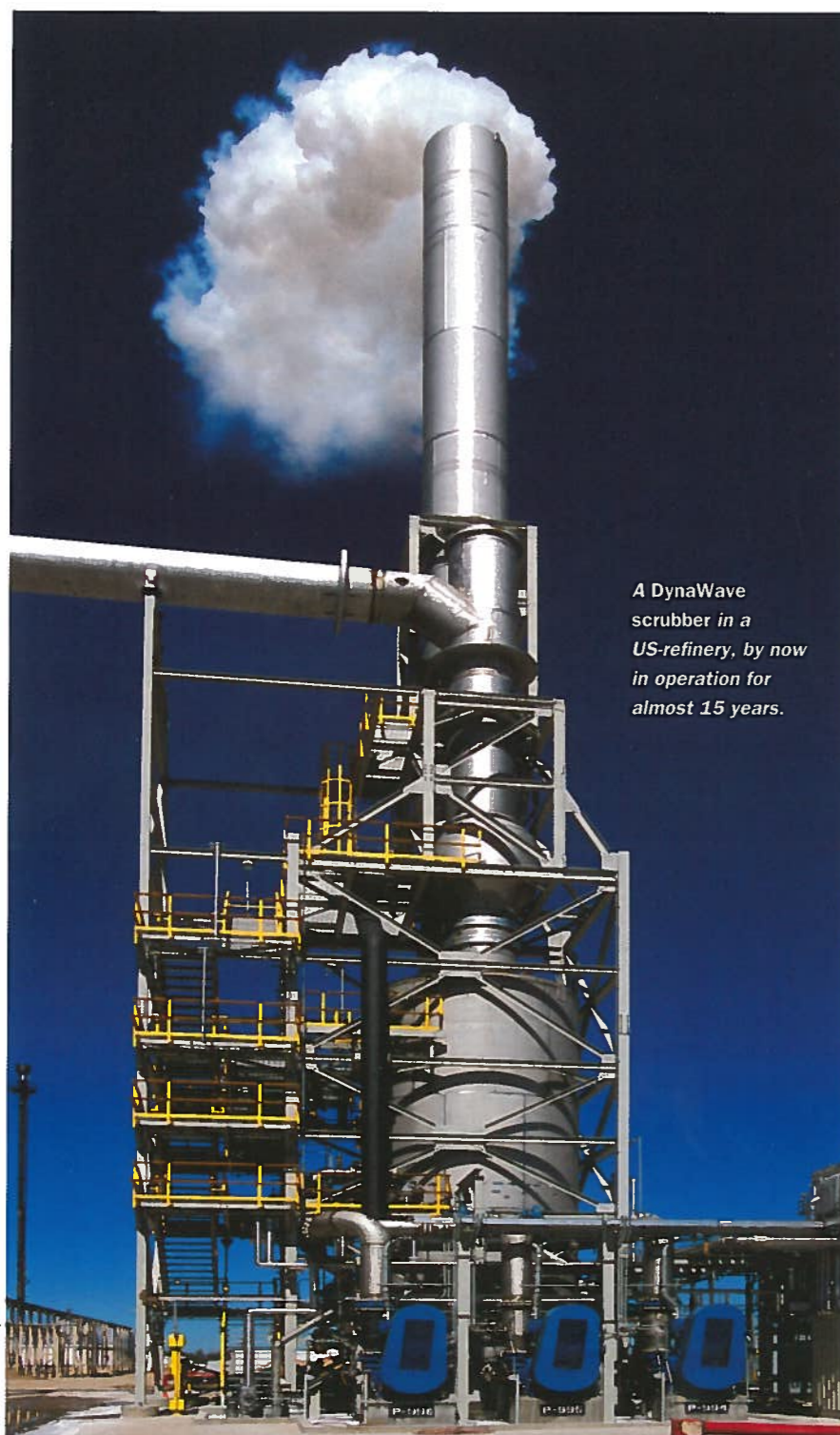


# Controlling refinery SO<sub>2</sub> emissions



A DynaWave scrubber in a US-refinery, by now in operation for almost 15 years.

PHOTO: DUPONT/MECS

DuPont Clean Technologies describes two wet scrubbing options to help refiners meet increasingly more stringent sulphur dioxide emissions legislation even during start-up, shut-down and maintenance conditions.

**R**efiners around the world are facing stricter emission limit requirements from national or regional bodies. The recent sulphur emission target changes in China are only one of the many examples. EU countries, as well as India are looking into the same matter. On the other side of the Atlantic, the United States Environmental Protection Agency (US EPA) is proposing a new Clean Air Act targeting the emissions of hazardous air pollutants from petroleum refineries. The suggested new rule – RIN 2060-AQ75 – would revise emission control requirements for flares, storage tanks and coking units at oil refineries, as well as eliminate emission limit exemptions during start-up, shutdown and malfunction (SSM) periods.

In the drive to continue satisfying market demand, the refining industry has also had to increase production from unconventional oil fields with heavy oil fractions. That has resulted in products with higher sulphur content, increasing the need for desulphurisation technologies. Refiners, therefore, now have to address a triple challenge: process increasingly sour crude while simultaneously reducing emissions and increasing output. That is not an easy task, particularly in the current market.

## Abatement technologies

Many refiners struggle to control emissions effectively and efficiently. Common sources of airborne pollutants in a refinery are:

- Fluid catalytic cracking unit regenerators (SO<sub>x</sub>, NO<sub>x</sub>, particulates)
- Claus plants, with or without tail gas treatment units (H<sub>2</sub>S, SO<sub>x</sub>)
- Sulphuric acid regeneration units (SO<sub>x</sub>)
- Fluid cokers (SO<sub>x</sub>, NO<sub>x</sub>, particulate)
- Fired heaters (SO<sub>x</sub>, NO<sub>x</sub>, particulate)
- H<sub>2</sub>S flares (H<sub>2</sub>S)
- Power plants and boilers burning HFO, coal, petroleum coke (SO<sub>x</sub>, NO<sub>x</sub>, particulates)

In order to tackle this challenge, DuPont Clean Technologies offers two complementary, proven scrubbing systems as a solution for refiners who need to cut SO<sub>x</sub> emissions and/or need to control particulate emissions efficiently. By reducing atmospheric emissions of H<sub>2</sub>S, SO<sub>x</sub>, NO<sub>x</sub> and particulates from major refinery sources, the BELCO® EDV® and the MECS® DynaWave® wet scrubbing systems together provide a holistic solution that makes air pollution control easy and reliable. Refiners that have installed such scrubbing systems have been able to handle the liquid and solid by-products of scrubbing with their existing on-site facilities and practices.

The BELCO wet scrubbing technology is well suited and widely used for treating flue gas from fluid catalytic cracking unit regenerators, fluid cokers, fired heaters and boilers. Its unique open-tower design and special non-plugging features control all emissions in a single upflow tower, eliminating the need for separate devices to individually control particulate, SO<sub>x</sub> and NO<sub>x</sub> emissions. The DynaWave wet scrubbing technology is a Claus tail gas treatment unit (TGTU) supplement or, in the case of small SRU's (lower than 50 t/d capacity), even an alternative to the Claus TGTU itself. By injecting the caustic liquid counter-current to the gas flow, this scrubber type will work under much higher liquid to gas ratios than conventional caustic scrubbers. This unique feature allows the scrubber to handle much higher acid levels and therefore operate even when the upstream TGTU is in start-up, shut down

or malfunctioning ('SSM') mode. In addition, DynaWave technology is widely used in sulphuric acid regeneration units and is perfectly suited to treat H<sub>2</sub>S flares. With the combination of these complementary refinery scrubbing technologies, DuPont Clean Technologies believes that it offers an integrated solution to refiners' environmental needs.

## Continuous emissions control

An unscheduled shutdown of a major refinery process unit is not an option for the majority of refiners. Process units are expected to operate 24 hours a day, 365 days a year for multi-year operating campaigns. Whatever the scenario, emissions must be minimised while product is generated and sold to the market. BELCO technology is a proven and robust technology that can reliably control FCCU regenerator flue gas emissions in a single upflow

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scrubber tower for years of uninterrupted operation. With over 140 units licensed on FCCUs worldwide and additional systems on other major refinery processes (fluid cokers, fired heaters and boilers), this low energy wet scrubbing system has been recognised by oil refiners around the world as the leading scrubbing technology in its field. The BELCO® Technology supports FCCU operating campaigns typically running 3-5 years or more of uninterrupted operation, providing continuous emission controls with no maintenance shutdowns. This allows refiners to keep the FCCU running at all times, while controlling flue gas emissions and keeping emission control costs as low as possible, so they can focus on production.

## Flexibility in use

As a result of the new regulations, oil refiners will not only have to meet air emission requirements for sulphur plants during normal operations, but now also during SSM periods. They must operate under these constraints while meeting production goals. In many regions that includes operating the facility continuously and reliably for a minimum cycle of four to five-

years, and generating products that meet the market's quality expectations in an economically viable way. This had led a large number of refiners to consider parallel trains to assure continuous reliability, but is this cost really a necessity?

DynaWave technology is the only wet gas scrubber technology that makes it possible to fully bypass the Claus unit or the Claus tail gas treatment unit directly to the incinerator and still meet emission limits at the stack. DynaWave is >99% efficient in removing SO<sub>2</sub>, which can bring emissions down to ultra-low levels under any given circumstances at the upstream sulphur plant. It offers a very reliable and easy to operate, low capital investment solution with a minimal footprint. The high on-stream reliability is proven in more than 400 installations in various industries worldwide. The technology combines gas quench, SO<sub>2</sub> removal, particulate elimination and sulphite oxidation all in one vessel, making it ideal for some of the most demanding applications. Around two dozen installations were specifically designed for sulphur removal tail gas treatment applications within refineries. Recently, DynaWave was integrated in an existing Claus unit design for a facility in the Middle East. Here, acid gas flaring in all possible operating scenarios, including start-up to shut-down and maintenance, will not lead to an increase of SO<sub>2</sub> emissions. Other operating examples like this exist in other regions like East Asia and North America and more new designs are being engineered as we speak in those regions, as well as in North-Africa

New refineries in Africa and Asia are currently also being designed to include both wet scrubbing technologies from DuPont Clean Technologies to meet environmental requirements under any given circumstance and to achieve continuous and reliable operation.

## Conclusion

Emission control technologies must support refining production goals. Refineries must be able to operate continuously and reliably in order to meet market demand for quality and cost without generating emissions that violate regulations. By treating the main sources of SO<sub>x</sub> emissions in the refinery segment with BELCO EDV and MECS DynaWave wet scrubbing technologies, DuPont Clean Technologies offers an integrated technical solution to SO<sub>x</sub> emissions control for both new and existing refineries all around the world. ■