Leveraging real-time environmental analytics to improve air quality performance

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The Problem

Federal, state and local air quality mandates are becoming more stringent. Regulations on greenhouse gas emissions, emanating from the U.S. Environmental Protection Agency and other regulators, are placing more scrutiny on energy producers and industrial facilities. Corporate shareholders are requiring increased sustainability reporting to assure that environmental policies of companies in which they have invested are being established and maintained. The outcome is an increasing amount of compulsory information that is required of the refineries or similar industries. It is estimated that even small refineries can generate more than one million calculations daily, whereas large facilities can create seven to ten times that amount each day. The increasing number of regulations, larger data collection ability and the complexity of calculations needed to provide accurate and timely information, has moved environmental compliance requirements into the realm of Big Data.

Complicating the data gathering and dissemination is the fact that data collected from both the operations and environmental departments in many facilities is diverse. It is used to generate different reports containing subsets of common information. Some of the information is needed in real-time, while other data is used for assembling periodic reports. This multi-purpose use of information necessitates a robust system that provides transparent, timely and accurate data to produce trusted results for regulatory reporting as well as for all stakeholders.

A U.S. refinery is an example of success from introducing advanced environmental monitoring and reporting software. The refinery produces approximately 100,000 barrels-per-day (bpd) of a broad product slate that includes gasoline, diesel, jet fuel and asphalt. Recent corporate-sponsored enhancements include the installation of leading-edge air emission control technologies at the refinery to monitor and measure concentrations of CO, NOx, SO_2, and H_2S.

The plant previously generated more than 25 separate Excel spreadsheets with complex macros and links to external data sources in order to meet the regular reporting requirements. The integrated data was as diverse as its source and had to be massaged and unified for consistent presentation. The spreadsheet data was then amalgamated into monthly reports for review and submission by plant management to environmental regulating bodies and corporate management.

Regulators conducted periodic and un-announced audits, requiring a reporting consistency and traceability of current and historic data that was often difficult to attain with existing software and manpower. The addition of new regulation requirements increased data points produced from analysers throughout the plant and expanded unit operations further complicating the reporting process. Data gathering and dissemination were usable for operations guidance based on hourly and historic emissions concentration averages, but these are often inconsistent for reporting purposes. Internal monthly status reports could contain dated information, not always conducive for proactive problem solving.

Emissions Monitoring System Implemented

The refinery investigated several software alternatives with specific criteria in mind. The facility required a set of transparent, standardised calculations that could be deployed to new units as the plant expanded and to new employees responsible for accumulation and reporting. The system needed to eliminate any transposition errors due to transfer of manual data from one system to another. The selected system also needed to provide real-time, consistent information to all stakeholders, addressing the special needs of management, the environmental department and operations.

The refinery selected a cutting-edge software suite, ENVision™, designed and implemented by Wood Group Mustang's instrument and control business unit to satisfy the plant's real-time and long-term requirements. The robust package handled a large volume of data and provided sophisticated calculations on a real-time basis, delivering timely alerts and notifications replacing multiple manually prepared spreadsheets. The new system virtually eliminated preparation errors.

ENVision provided consistent calculations across all process unit analysers. Its robustness allowed it to provide immediate information for unit operations, environmental departments, plant and corporate management. Data was consolidated and maintained in a central location. The software also provided transparency of the calculations process so external audits could be expedited with verifiable information and readily available historical records could be tied to past reports submitted by the plant to the regulators.

The software offered reporting templates that provided the standard information needed for regulatory compliance. In addition, report formats could be tailored to the plant's requirements for producing the necessary reports specifically needed by each stakeholder.

Results

The adoption of the air emissions analytics software suite uniformly consolidated the vast amount of data and made it available to all stakeholders in real-time. The number of reports generated dramatically reduced from 25 to three. Macros to supplement the Excel spreadsheets were not required, and complexity was minimised. The benefits of this implementation reach throughout the entire organisation and include:

Operations – With everyone relying on the same data set, operators immediately know the limits they are monitoring. Short time emissions averages, taken as little as fifteen minutes, are available through the software. Through alerts, there is an immediate visibility of potential problems. The operators have confidence in the information and therefore make immediate adjustments to the process to avoid possible fines.

Environmental – Reporting has become much easier. Gathering and compiling reports is considerably less time consuming with little rework. On a recent state audit, regulators were able to verify the data contained in the system of record was identical to previously submitted reports. Central storage of data made it immediately available on demand for verification with no conflicting information or discrepancies. This exercise produced considerable time savings for the multi-person audit team.

Plant Management – With the system's robustness and ability to quickly process the amount of data, the plant manager now receives a daily report from operating activities and emissions values from the previous 24 hours. The reporting promptness and clear visibility of performance trends, potential threats and ongoing issues allows for pre-emptive response.

Corporate Management – A standardised data interface from the system software can immediately transfer data resident at the operations level, making it available for the corporation's enterprise reporting. Corporate management's unique needs do not place any additional burden on the plant's environmental department personnel.

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