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Development of Reliability-centered Maintenance Model for Delayed Cokers & Sulphur Solids Handling Systems

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Abstract

Given high historical profit margins associated with Delayed Coker units operating in a heavy oil refinery, it is imperative that refiners understand the total operating and maintenance requirements of these units, particularly downstream solids handling systems, in order to maximize both their productivity and reliability. In a similar fashion, large refiners and heavy oil/bitumen upgraders are also more dependent than ever on reliable processing and ultimate disposition of sulphur, the other major by-product of heavy oil refining. Increasingly in the future, North American and especially Canadian sulphur producers, will have to convert more molten sulphur to solid prill in order to enable export of this product to international fertilizer manufacturers. These additional sulphur solids processing requirements for refiners and upgraders largely represent new operations as well and will bring additional operating and maintenance challenges.

The units and systems designed for coke cutting, sulphur forming, and their related downstream handling and logistics systems are complex, interconnected and both mechanically and maintenance intensive. A deep understanding of solids handling systems, and their associated operating and maintenance requirements is not widespread within the refining industry. The consequences and costs of sub-optimal operation of these units will be significant and often extremely detrimental to refinery and upgrader performance.

The paper describes the development of a predictive maintenance and reliability model that is focused on the mechanical material handling and logistics operations, including coke cutting, of a large refinery delayed coker unit. Data for the model was obtained from a case study of a large customer‘s coke cutting and coke movement operations. The model quantifies the impact of the preventive maintenance program on the direct and associated maintenance cost of the facility, as well as consequential lost opportunity costs arising from unplanned coker downtime. The paper reviews the model reliability background, which includes the preventive maintenance vs repair cost parabola and a method of classifying maintenance repairs into four types of occurrences. It describes each type of repair and discuses their cost and their consequences. ***The model allows the refiner to develop an optimized preventative maintenance program to deliver the lowest total cost of ownership for the DCU solids handling system***. The model can be readily adapted and applied to sulphur forming and logistics operations as well.