Investigation of critical failures using root cause analysis methods: Case study of ASH Cement PLC

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Investigation of critical failures using root cause analysis methods: Case study of ASH Cement PLC

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Abstract

Like other modern day process industries, most cement manufacturing operations are continuously sorting after state-of-the-art failure identification and analysis approaches that can help avert the reoccurrence of failures, owing to the huge costs of downtime associated with critical plant assets such as the rotary kilns. Research-based investigation of the root causes of high impact failures of critical industrial assets have been dominated by the use of complex mathematical methods for analysing experimentally and numerically simulated scenarios. While the academic contributions of such approaches is highly commendable, the potential of deploying them to the industry as well as their ability to simulate experiential learning is significantly lower than when "real life" industrial case studies are used. Through the application of a fully integrated cement plant located in Northern Nigeria as case study; this paper employs two popular risk analysis techniques (fault tree analysis and reliability block diagram) to detect the causal factors as well as their interrelations of a chronic rotary kiln refractory brick failure. Unlike the previous plant-based investigations which continuously attributed the failure causes to refractory brick design/manufacturing, the current approach provides a detailed, almost macroscopic dimension of vulnerabilities in maintenance, operations and quality practices in the plant. Through a combination of theory and immense practical knowledge of the case study plant, the current investigation team also provided several vital and realistic recommendations that could eliminate or significantly reduce the possibility of kiln refractory brick failure in the plant. The cornerstone of this