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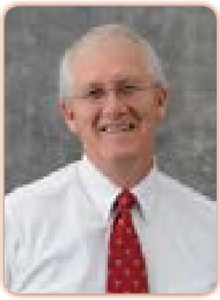

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Transient analysis of industrial scale low-profile multi-point ground flares

Increasing production of gas via fracking technology in the United States has led to the re-emergence of the chemical industry in the US with several new chemical production facilities built in the gulf coast region. Many of these new production facilities include large multi-point ground flares (MPGF). Low-profile MPGFs are very efficient in processing large quantities of flare gas yet pose significant design challenges including elongated flames, high radiation flux to surrounding equipment and associated personnel safety. CFD tools have been used to analyze MPGFs having hundreds of flare burner tips surrounded by specially designed wind fences operated in a chemical plant. This presentation provides an overview of these flares and discusses recent analysis using a transient LES based CFD tool called C3d. This tool includes governing physics to describe soot formation, radiant flux, flame shape and height for an operating industrial scale MPGF. Previous model verification has been conducted for large pool fires and the code has validated for simulating flare performance by comparing measured flame height/shape and radiation flux to simulation results for single burner and three-burner tests when burning ethylene. Comparing transient predictions to steady state results illustrates the need to use transient analysis to capture flame dynamics and associated emissions production and radiation flux during operation of MPGFs in chemical plants. Using the right tool to correctly analyze these complex combustion systems is critical to safe and efficient operation of MPGFs to minimize environmental impact and reduce safety risks.

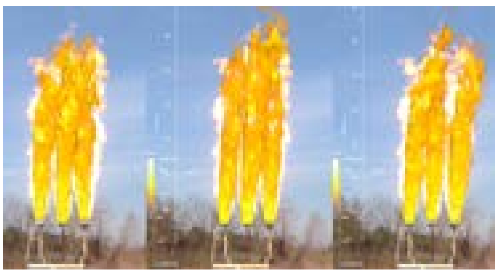

Figure1: Code validation for 3-burner test

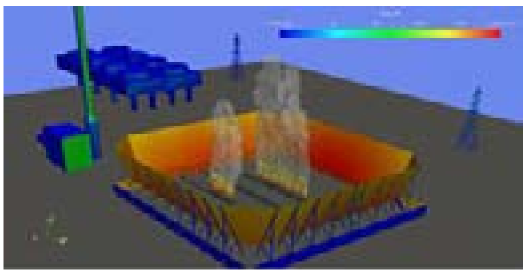

Figure2: MPGF located near surrounding plant equipment

Biography

Joseph D Smith has a PhD in Chemical Engineering with 25 years' experience in the Chemical and Petrochemical Industries. He has published over 40 papers, has given more than 80 conference papers and holds eight patents. He contributed two chapters to the John Zink Combustion Handbook and published one chapter in the Industrial Burner Handbook. He serves as an expert witness for Flare Performance and Hydrocarbon Processing. He has developed and applied comprehensive CFD models for optimization of industrial scale combustion equipment. He has founded and led startup companies that provide engineering services for the petrochemical and fossil energy industries and most recently focused on developing advanced sensor technology to quantify flare performance. He has worked for several companies including Dow Chemical, Cabot Corporation and Koch Industries and currently holds the Laufer Energy Chair at Missouri University of Science and Technology (formally Missouri Rolla).

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