IChemE Oil & Natural Gas Special Interest Group

energy institute

heat transfer society

Joint webinar by EI, SONG and HTS on 28 April 2021 at 16:00 BST

"Mechanical Response of Shells to Tube Rupture in STHEs"

Colin Deddis, Rob Kulka and Alan Clayton

A shell and tube heat exchanger can consist of high- pressure gas through tubes and low pressure liquid in the shell. A tube failure results in a gas leak into the shell which can result in a high pressure surge travelling through the liquid before the pressure relief system has time to take effect. Guidelines have previously been published by the Energy Institute on the safe design and operation of shell and tube heat exchangers to withstand the impact of tube failure.

The Guidelines assume that shell stresses can be determined from a conventional static analysis using the peak surge pressure. However, under adverse circumstances the shell may oscillate due to the sudden pressure change, dynamically amplifying the shell stresses above those determined from a static analysis, to a level which may damage or fail the shell wall. The dynamic response of the shell to the pressure transient has therefore been evaluated in a range of typical configurations, to determine the additional considerations that must be made during design of heat exchangers and their system relief devices.

Colin Deddis is a Fellow of the IChemE with over 30 years' experience in senior technical roles in Operating Companies and Consultancies in the Oil and Gas Industry. He became an independent consultant in 2018 and has chaired the steering committee for the Energy Institute's work on overpressure protection of shell and tube heat exchangers since 2009. He is a contributing member to API committees on pressure relieving systems.

Rob Kulka is the Section Manager for Asset Integrity Management at TWI, and is a chartered mechanical engineer with over 15 years' experience. He has expertise in analysis of material performance and the demonstration of structural integrity of components across a range of industries, through the use of fitness-for-service techniques supported by complex computational analysis, specialising in the development and application of advanced fracture mechanics assessment techniques.

Alan Clayton was trained at Rolls-Royce and has spent most of his working life in the nuclear industry becoming a Divisional Head in structural integrity and materials in AEA Technology. He became an independent consultant in 2000 and has specialised in developing methods for the assessment of vessels under internal shock loads being a contributor to the ASME VIII Division 3 rules for impulsively loaded vessels. He is a contributing member to ASME and ASTM committees.

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