

The First (2007) ISOPE Strain-Based Design Symposium - A Review

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ABSTRACT

The aim of this first symposium on strain-based design of pipelines was to bring together a multidisciplinary group of industry experts to discuss the challenges of designing pipelines subjected to high strain. The symposium included nearly fifty presentations and comprehensive proceedings covering all aspects of strain-based design. This review summarizes the key themes of the symposium including *projects, design, mechanics, assessments, materials, and testing*. The work presented at the symposium shows the broad range of efforts underway to address the challenges of strain-based design of pipelines as well as the work remaining to be completed to have an industry-wide consistent solution. Rather than simply providing a compilation of these various studies, this review aims to assess the work within each topical area collectively. This assessment of the state of the art and remaining challenges from the symposium will serve as a backdrop for the Second (2008) ISOPE Strain-Based Design Symposium.

KEY WORDS: Strain-based design; tensile strain capacity; fracture assessment; line pipe.

INTRODUCTION

The ever increasing consumption of energy worldwide has led to the strong demand for development of known oil and gas resources in remote locations. These potential development locations are often far from major population centers because of the harsh natural environments in these parts of the world. Often cited are the vast resources both on- and offshore in and around the arctic circle. Environmental loads from offshore ice, discontinuous permafrost, and seismic activity impose a strain demand on the pipelines needed to bring the oil and gas to population centers from these remote resources. Similar arctic challenges persist into regions of ice flow and permafrost beyond the arctic circle, including regions currently under development such as Sakhalin Island (Russia's far east) and offshore eastern Canada, shown in Figure 1. Depending on pipe routing options and local environment, these arctic loading conditions may be localized to small sections of the pipeline or exist over great expanses. While stress-based design of pipelines is strongly preferred, the nature of these

environmental loads make strain-based design a necessity in these types of harsh environments. Accurate prediction of this environmentally-imposed strain by pipeline designers and accommodation of this strain by the materials used during pipeline construction is essential to operate a safe and reliable pipeline.



Fig. 1 Global hydrocarbon basins located in ice environments. (Kenny 2007)

Seismic loading and soil instability are challenges in a variety of locations worldwide. Consideration of seismic activity often brings to mind the catastrophic earthquakes that have affected major populated areas around the Pacific rim, but in reality seismic activity and major active faults are found throughout the globe. Depending on the nature