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## **Risk Analysis as Decision Tool to Upgrade Aging Offshore Trunk Lines**

L. Angibeaud, SPE, Saudi Aramco

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### **Abstract**

All over the world, the operation of old and aging pipelines, all potentially subject sooner or later to internal corrosion, raises concerns about the risk and the consequences of pipeline failures. With the exception of third party damages, most cases of failure are caused by internal and external corrosion. In Saudi Arabia Offshore Operations, old pipelines were originally designed for "dry" oil operations and constructed without scraping facilities. Therefore, the observation and monitoring of internal corrosion is virtually impossible without significant modifications. In new pipelines, facilities allowing the internal condition monitoring are included at the design stage. Indeed, loss of production and detrimental environmental impacts are less and less acceptable to society. They are indicators of poor performance in the public's opinion, and create costly business expenses.

#### **Observations:**

Saudi Arabian Offshore Operations operate a very large number of old pipelines for which intelligent scraping facilities have not been retrofitted. This upgrade requires very large capital expenditures and for that reason cannot be performed on every offshore line. To respond to the dilemma of either doing "nothing" or to invest a substantial amount of money without an absolute certainty of success, a risk analysis has been performed.

#### **Approach:**

Several alternative decision trees are developed to portray the decision process. The pipelines are analyzed based on the risk analysis described as:

- Possible events which may occur during a pipeline's lifetime.
- Investments and costs associated with the event described.
- The cumulative risked capital and total risked capital.

#### **Significance:**

The risk analysis allows a comparison of different pipeline situations, and the analysis helps in building the business case to install intelligent scraping facilities. When the scraping scheme is applied, the investment increase is associated with a risk reduction in pipeline failure.

### **Introduction**

This paper discusses the challenges related to the risk of leaks in old pipelines that have been encountered in large Saudi Arabia offshore oil fields. In some countries the reaction to safety and environmental concerns is a call for more regulations. Operators are looking at how to ensure integrity of existing pipelines, especially the non-scrapable pipelines. Worldwide, the industry recognizes the following methods to assess the integrity of pipelines at scheduled intervals: