Ignition Probability for High Pressure Gas Transmission Pipelines

For most fuels transported by pipeline, whether or not ignition of an accidental release occurs is a critical factor in determining the extent of the resulting hazard. The probability of ignition is therefore a key input when undertaking pipeline risk assessments and the value chosen is a direct multiplier of the risk calculated. Typically, the ignition probability assigned is based on an analysis of historical data. However, the pipeline industry has a good safety record and major incidents are rare, sometimes resulting in widely differing values being used due to the scarcity of reliable data.

For high pressure natural gas transmission pipelines, it is observed that ruptures of large diameter underground pipelines operating at high pressures can result in ignited releases even in remote areas with no obvious ignition sources present. Conversely, failures of small diameter pipelines operating at lower pressures rarely result in ignited releases, suggesting that ignition sources generated as a result of the failure event itself may be significant in causing ignition of high pressure natural gas releases from underground pipelines.

The results of analysis previously reported at IPC2002 indicated a trend for the ignition probability to increase with pd^2, with p the pipeline operating pressure (bar) and d the pipeline diameter (m). The relationship forms the basis of the default ignition probabilities recommended for use in the PIPESAFE package developed for risk assessment of gas transmission pipelines. Since the previous study was carried out, the number of pipeline rupture incidents in the dataset used has increased by about 20%, and following a recent review, the statistical analysis has been extended and refined.

This paper reports the results of recent analysis of the most comprehensive incident dataset available to Advantica for natural gas transmission pipelines, presenting the correlation derived from a simple statistical analysis together with consideration of possible physical explanations for the trends observed based on an ongoing programme of research into the causes of ignition.