Probabilistic approaches are often used when considering explosion risk of offshore and onshore facilities. However, there are a number of limitations with such explosion risk assessment methodologies. These are primarily due to the uncertainties that are inherent with the technique. Statistical data is used to provide input (e.g., wind probability data, leak frequency data, ignition probability data). Each of these statistical distributions have their own associated uncertainties. Additional uncertainties arise in the modelling techniques used to determine the consequences of a release and subsequent explosion. Finally, there is a large element of engineering judgement to select the most appropriate scenarios to consider. This brings further uncertainties to the problem.

How these uncertainties propagate through the analysis are poorly understood and communicated. Good studies perform some level of sensitivity to try and highlight the uncertainty to the client; however, this is typically not done well or at all. Single values are often presented without any associated error bars or confidence levels, which then get fed directly into design. This presents a significant point of concern as it could lead to facilities being under designed. Here, we present a methodology that shows how uncertainties (both in the inputs and in the models used) propagate through the explosion risk analysis. These enable the results of the analysis to be presented with confidence intervals to allow informed design decisions to be made. Alternatively, the uncertainty can be included in the final estimates of design pressures.

By understanding and highlighting the uncertainties with the approach, we can better understand how improvements can be made. Efforts can be focussed on improving the data for inputs that will have the most significant impact on the accuracy of the results. In addition, we can show where there is a risk the analysis may not produce conservative results and potentially lead to dangerous design.