Subsea Hydrocarbon Production Leak Detection Systems Using Process Data

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Introduction

The intent of writing this technical report is to share best practices for designing, implementing, and maintaining process data-based leak detection capabilities on subsea multiphase systems. This has been driven by a lack of effective automated leak detection systems and operator training to recognize the occurrence of leaks on subsea production systems.

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1 Scope

1.1 General

This technical report provides considerations and recommendations for design, operation, maintenance, and training related to leak detection on multiphase subsea production gathering systems and gas injection systems. The scope is limited to methods using internal process sensors to detect leaks that are identifiable from process data. This report does not cover leak detection for umbilical systems, subsea trees (upstream of subsea choke), well downhole tubing, water injection systems, and export pipelines.

It is impractical to define a single threshold for detecting leaks from a change in process conditions (e.g., pressure, temperature, flowrate), as this is system dependent. Some factors that influence thresholds are:

— fluid properties and flow regime;

— total flowrate;

— operating vs. hydrostatic pressure;

— reservoir properties;

— system volume;

— subsea layout and flowline bathymetry.

In general, historical subsea leak size distribution is bimodal; they are either too small to be identified from process data or so large that the resulting process changes are readily observable. Leaks detectable by process data under flowing conditions are typically in the order of 100–1000s bbl/day, while smaller leaks (which cannot be detected from flowing process data) are generally less than 1–2 bbl/day and can only be detected when shut-in or by general observation (slick detection, periodic hardware inspections, third-party reporting).

1.2 Leak Detection Considerations

It is recognized that no one leak detection method or technology may be applicable to all subsea systems because each system is unique in design and operation. Further, leak detection techniques have a detection threshold below which a hydrocarbon release cannot be detected. Detectable limits are difficult to quantify because of the unique characteristics presented by each system. Limits are therefore determined and validated on a system-by-system and, perhaps, segment-by-segment basis.

Subsea leak detection systems are intended to enhance human judgment when some type of intervention or shutdown of the affected subsea system is warranted.

This document is not intended to exclude other effective subsea leak detection methods.

2 Normative References

There are no normative references in this document.

3 Terms, Definitions, and Acronyms

For the purposes of this document, the following definitions apply.

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