PIPELINE AND RISER LOSS OF CONTAINMENT 2001 - 2012 (PARLOC 2012)

Update Project by Oil & Gas UK and EI

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PARLOC STEERING GROUP

Update project guided by PARLOC steering group
- Hollie Harton, BP (chair)
- Sam Botterill, Energy Institute
- Rebecca Borresen, Oil & Gas UK
- Hazel Hancock, HSE
- Jerry Baker, Dana Petroleum
- Jim MacRae, Genesis Oil & Gas
- John Lawson, Chevron, and PLUG chair
- Andy Bolsover, DNV GL (primary author)

Main update project started mid 2013
HISTORY

• Conceived following Lord Cullen’s inquiry into Piper Alpha disaster
• Originally published in 1990
• Published again in 1992, 1994, 1996, 2001
• No update since PARLOC 2001 publication
• PARLOC moved online in 2006/07. Unsuccessful in keeping up to date
• Hard copy update commenced 2013
  o Data confidentiality
  o Data integrity (merging different databases)
  o Failure frequencies are relatively stable over time
  o Traceability required for use in Quantitative Risk Assessments (QRA)
FAILURE FREQUENCY

Numerator is very small compared to denominator. Steering Group believed accuracy of incident numbers was good (especially compared to pipeline experience).

\[
\text{Failure rate} = \frac{\text{Number of incidents or leaks}}{\text{Pipeline (or riser) operating experience}}
\]

Different and contradictory information regarding numbers, types, sizes, locations of pipelines. Assumptions made regarding experience i.e. operating years.
PRELIMINARY WORK - DATA

- Preliminary study work funded by BP (2013)
- Purpose - review the available sources of data
- Four main sources of incident data
  - PON1 data from DECC
  - RIDDOR data from HSE (provided to OGUK)
  - HCRD (not carried forward)
  - Operator questionnaires – development of detailed questionnaires
- Three sources of pipeline data – more difficult
  - Infield Systems Ltd. commercial database
  - PARLOC data base – merged data containing PARLOC 2001, FishSafe
  - DECC database – downloaded from website
CHANGES – PARLOC 2012

Different geographical scope
- All offshore pipelines and risers on the UK sector of North Sea, eastern Irish Sea, WoS

Different time period with entirely new incident data
- Covers period from start of 2001 through end of 2012

Detailed description of methodology included
- Comprehensive description of incident and pipeline databases, methodology

Different method of handling data uncertainties
- Much wider range of uncertainties is recognised, and sources of uncertainty are discussed in detail
MAIN WORK SCOPE

- Incident database definition
  - Efforts to retrieve PARLOC 2001 data
  - Compilation of incidents (PON1, RIDDOR) relevant to each operator
  - Send list of incidents, questionnaire to each OGUK member operator
  - Follow up emails, phone calls, etc.
  - Quality control / quality assurance checks of all responses
  - Compilation of responses into PARLOC 2012 incident database
MAIN WORK SCOPE (CONT.)

• Pipeline database definition
  o Review of DECC pipeline data (rejected – unsuitable)
  o Review of existing PARLOC pipeline data (rejected – unsuitable)
  o Review of Oil & Gas UK infrastructure data (best available for umbilicals)
  o Review of Infield Systems Ltd for pipeline and riser data (best available for numbers of pipelines/risers, attributes, etc.)
  o Compilation into PARLOC 2012 pipeline database, using cross referencing with PL numbers as much as possible
MAIN PROCESS STEPS

- Incident database definition
- Pipeline database definition
- Incident data analysis (number of incidents)
- Pipeline data analysis (pipeline operating experience)
- Loss of containment frequencies

Especially important to document methodology, assumptions and how uncertainty in the data is handled.
INCIDENT DATA

- PON 1 data: Held by DECC, partially available online, data up to end of 2006 obtained through FoI request
- RIDDOR data: Held by HSE, obtained through Oil & Gas UK
- OIR12 data (HCRD) excluded because: potential for double counting, no cross references to RIDDOR, some data fields not publicly available, all OIR12 records also reported through OIR9B RIDDOR
- Incident data reviewed and lists of incidents relevant to PARLOC were compiled
INCIDENT QUESTIONNAIRE

• Questionnaire issued and sent to pipeline operators together with lists of known incidents
  – 45 questions - more detailed than previous questionnaire
• Questionnaire responses reviewed
  – Completeness, cross checks against pipeline database, double counting, missing incidents, etc.
• Data queries involved reissue of many questionnaire responses (and also some where no response had been received)
• Questionnaires also identified some additional leak incidents that did not appear in RIDDOR or PON 1 data
PARLOC 2012 INCIDENT DATABASE

- 183 loss of containment incidents
- 23 near miss incidents
- Plus some incidents excluded from study:
  - 6 incidents in 2013
  - 39 irrelevant incidents
PIPELINE DATA

• Not easy to identify a suitable pipeline database
• Existing databases (DECC, CDA, PARLOC 2001) were either incomplete, contained significant errors, or not available in a suitable form
• Best available database for steel and flexibles was commercial database from Infield Systems Ltd
  – All database fields complete, broad agreement with other data sources
  – But no PL numbers, no cessation dates, database fields not aligned with incident database, incomplete riser identification, no control umbilicals
• Best available database for control umbilicals was from Oil & Gas UK
DATA ANALYSIS

• There is a significant amount of missing data in incident descriptions. Some data is marked as ‘NA’ meaning data is not available
• There are some plausible categories of incidents where no incidents have been reported
• All results fully anonymous
• Produce only generic statistics
NOTES ON METHODOLOGY

• Key assumptions are documented in PARLOC report
• Analysis methodology accounts for missing data – assumed to be “missing at random”
• Careful reallocation of incidents where some data categories are NA (using pro rata redistribution)
• Use of additive smoothing method to account for categories of incidents where no leaks have been observed
PARLOC 2012 REPORT

1. Introduction
2. Incident database definition
3. Pipeline database definition
4. Incident data analysis
5. Pipeline data analysis
6. Loss of containment frequencies
7. Discussion
8. Conclusions & recommendations
9. References

Annex A: Incident questionnaire
Annex B: Description of incident database
Annex C: Pipeline population data sources
Annex D: Glossary
## RESULTS - STEEL PIPELINES & RISERS

<table>
<thead>
<tr>
<th>INCIDENTS</th>
<th>Steel Pipelines</th>
<th>Steel Risers</th>
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<tbody>
<tr>
<td></td>
<td>Reported</td>
<td>Estimated</td>
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<tr>
<td><strong>Totals</strong></td>
<td>85</td>
<td>92.7</td>
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<th>Steel Pipelines</th>
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<tbody>
<tr>
<td></td>
<td>Number</td>
<td>km*years</td>
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<tr>
<td><strong>All diameters</strong></td>
<td>1,372</td>
<td>219,165</td>
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<table>
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<tr>
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<th>Steel Pipelines</th>
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<tbody>
<tr>
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<td>Estimated frequency (per km*year)</td>
<td>Estimated frequency (per km*year)</td>
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<tr>
<td><strong>All diameters</strong></td>
<td>4.23E-04</td>
<td>Included in pipelines</td>
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# RESULTS - FLEXIBLE PIPELINES & RISERS

<table>
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<td>10,133</td>
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<tr>
<td></td>
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<td>Estimated frequency (per km*year)</td>
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<td>All diameters</td>
<td>5.47E-03</td>
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## COMPARISON – PARLOC 2001 VS 2012

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<th></th>
<th>PARLOC 2001 Frequency (per km*year)</th>
<th>PARLOC 2012 Frequency (per km*year)</th>
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<tr>
<td>Steel pipelines</td>
<td>4.88 x 10^{-4}</td>
<td>4.23 x 10^{-4}</td>
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<tr>
<td>Flexible pipelines</td>
<td>4.66 x 10^{-3}</td>
<td>5.47 x 10^{-3}</td>
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<tr>
<td>Control umbilicals</td>
<td>No estimate</td>
<td>1.0 x 10^{-3}</td>
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REPORT & FEEDBACK

• Available from:
  www.oilandgasuk.co.uk/PARLOC

• Pdf report available to download free for Oil & Gas UK and EI members

• Please send any feedback to rborresen@oilandgasuk.co.uk
PLANS GOING FORWARD

- Development of UK offshore industry-standard pipelines database
  - Will require cooperation of pipeline operators
  - Oil & Gas UK – send pipeline and umbilical information for updating, checking, confirmation, correction
  - Updated, current pipeline database would benefit the industry

- Regular updates of PARLOC reports
  - 13 year gap made data collection difficult in some cases
  - Especially in situations where pipelines change ownership

- Improvements in incident data
  - Systematic, ongoing collection
  - Encourage reporting of loss of containment incidents when they occur
  - Encourage full reporting even if not covered by RIDDOR, PON1, etc.