

United Kingdom Onshore Pipeline Operators' Association

## Notes of Risk Assessment Working Group Meeting held on 23 November 2005 at Advantica's Offices at Loughborough

Present:-

|                  |   |                        |
|------------------|---|------------------------|
| Neil Jackson     | - | Transco (Chair)        |
| Roger Ellis      | - | Shell                  |
| Neil Macnaughton | - | BP                     |
| Richard Espiner  | - | BP                     |
| Jane Haswell     | - | PIE                    |
| Mike Acton       | - | Advantica              |
| Rod McConnell    | - | Independent Consultant |

Apologies – Peter Davis

### 1 Membership

Neil Jackson is now chairing the RAWG following the UKOPA Management Council review of governance and the need for member companies to chair Work Groups. Neil welcomed Mike Acton to the group. It was agreed that Mike's extensive experience of pipeline risk assessment would be valuable to the group and he should be invited to attend RAWG meetings while the Code supplements were being developed.

Steve Millington has left Huntsman so a new member is to be appointed to RAWG.

**Action 1** - Neil Jackson to discuss Huntsman membership with Mark Harrison. Also possible membership by IDNs and HSE to be reviewed.

### 2 Notes and Actions from Last Meeting March 2005

At the last meeting, Advantica had completed work to develop Limit State Functions for UKOPA and Jonathan Franklin handed out the report and individual company results for specific pipeline cases. Some difficulties were noted with small diameter pipelines – dent / gouge model may not apply to small diameter lines.

**Action arising** - Advantica to investigate and report back – this has been done and resolved apart from small pipelines <6".

Rod McConnell requires individual failure rates for ethylene lines for development of methodology and discussion with HSE.

**Action 2** - Neil Jackson to contact Jonathan Franklin to send failure rates to Rod McConnell

Meeting held on 10<sup>th</sup> November 2004 with Martin Goose and Stuart Pointer in Bootle – notes produced by Neil Jackson – HSE suggested writing to David Kyle.

**Action arising** - Neil Jackson drafted and sent letter – reply received from John Murray – now overtaken by events and 9 October 2005 meeting - Complete

Publication of results from the new Advantica model - at Pipeline conference at Orlando in May. Eventual objective is to get HSE to adopt the new model.

**Action arising** - This should be a topic for raising with Moira Wilson end April. – now overtaken by events and 9 October 2005 meeting – Complete

**Mitigation – Risk Reduction Factors for Protection of Pipelines.**

Improved way of developing Fault Tree analysis for slabbing and marker tape discussed by Neil Jackson and Rod McConnell at meeting on 18 February based on different analysis of machines which can or cannot cause pipe damage / pipe rupture.

**Action arising** – now being developed as part of Advantica and PIPESAFE group work with Mike Acton

UKOPA History of Land Use Planning Zones – paper written in February 2005.

**Action arising** – Paper revised and issued to UKOPA - Complete

Paper on F-N Curves for Pipeline Risk Assessments - paper issued in February highlighting some of the issues of applying Societal risk to pipelines.

**Action arising** – Paper to be issued to UKOPA - Complete

## **2 Working Group Pipelines/HSE/UKOPA meeting 13 Oct 2005**

A successful Technical Meeting was held on 13 October at Bootle chaired by Prof. Gordon Walker with 17 people present. Detailed final notes have been issued by Jane Haswell following comments from members and HSE. Constructive joint working with HSE on several aspects of risk assessment applied to LUP zones should now progress over the next few months. A list of actions were agreed at the meeting and these are included as part of RAWG program at the end of these notes.

**Action 3** – Rod McConnell and Jane Haswell to devise plan and resource requirements to resolve issues raised at the WGP / HSE / UKOPA meeting on 9 October.

Two key areas to be resolved are the apparent high failure rates which the HSE predictive model generates for small diameter pipelines (323 mm and less). It was suggested that one reason may be the non-applicability of predictive models to small pipelines because they were developed to predict failures for large diameter pipelines where historical failure rate data is sparse or non-existent. Further work is required to investigate and explain this discrepancy between HSE data for small pipelines which is 2 or 3 times higher than historical (UKOPA or EGIG) data.

**Action 4** – Rod McConnell to produce note explaining in detail the discrepancy in HSE failure rate data for small diameter pipelines.

The second main area concerns the application of the HSE jet fire model which gives very large flame height and flame diameter resulting in the consequence distance for the 30 second jet flame being almost as large as fireball effects, and giving large middle zone distances when calculating LUP zones. A quick comparison with the 60 bar gas release in Canada indicates that the HSE model over-predicts by at least 50%. Mike Acton suggested that the HSE fireball model should also remain under review.

**Action 5** – Rod McConnell to produce note explaining in detail the discrepancy in HSE jet fire model compared to other models and experimental data.

It was agreed that before further discussions with HSE, further work is required to understand these issues and so be able to discuss HSE model limitations in detail with the relevant HSE inspectors.

At the 9 October meeting, Glynn Hawkins, HSE Specialist Inspector responsible for the HSE failure rate data / predictive models, expressed interest in spending time at Advantica gaining a deeper insight into the work done to develop the new predictive model. Further aspects which could also be covered would be the change in Ground Movement failure rate resulting from BGS work, and failure rates for mitigation aspects.

**Action 6** – Neil Jackson to contact Glynn Hawkins and Advantica to set up a suitable date for such a meeting at Loughborough.

**Action 7** - For the consequence model aspects of jet fire, it was agreed that Rod McConnell to set up a discussion with Ian Hirst, HSE Specialist Inspector responsible for the HSE Consequence Modelling. This would also allow other aspects of ethylene, spiked crude and NGL modelling to be discussed.

3 Chapters of the HSE's PCAG manual describing full details of their methodologies has been obtained, but one key chapter describing the way failure rates are applied (including depth of cover) has not yet been received.

**Action 8** - Rod McConnell to request this Chapter of PCAG from HSE and also the index to see if other relevant sections should be obtained.

### **3 Work on Code Supplements for IGEM and BSI PD 8010 Codes**

A meeting at Ambergate on 20 October (Neil Jackson, Jane Haswell, Mike Acton, Rod McConnell) reviewed comments on the V2 draft and outstanding actions required to complete the Code Supplements. Jane Haswell has since issued:-

- Actions from the special meeting on 20 October
- collated draft with comments V0[1].5,
- Code supplement Gap analysis describing work to complete and red-yellow-green colour coded completion requirement.

The primary purpose of the Code Supplements was described as being for case-specific assessments taking into account local circumstances and providing guidance on how to apply risk assessment with established assumptions and justification.

The flowchart describing the processes which the Code Supplements seek to address is seen as particularly useful and it was suggested that the next re-write should encompass the stages in the flow chart.

**Action 9** - Jane Haswell and Rod McConnell to devise plan and resource requirements to resolve issues raised in the Gap Analysis for the Code Supplements.

**Action 10** - Jane Haswell and Rod McConnell to develop revised version of Code Supplements based on comments received.

## 4 Risk to Pipelines from Wind Farms

Neil Jackson circulated a single page description summarising a recent risk assessment of wind turbines and the potential risk to buried pipelines in the area. The recommendation is that wind turbines should be located at least 1.5 times the turbine height from a pipeline to minimise the risk to buried pipelines.

Risks from wind turbines include blade detachment, toppling of whole structure and blade nacelle becoming detached.

Three changes were suggested to the note –

- Making it clear that a full and comprehensive risk assessment has been carried out to obtain this conclusion
- Including the potential sources of hazard (3 mentioned above)
- Single reference to “high pressure pipelines” to avoid different terminology and meaning.

It was agreed that the note should be issued to UKOPA membership. RAWG members requested a copy of the full assessment if possible.

**Action 11** – Neil Jackson to issue revised note on Wind Farms and issue to UKOPA membership

## 5 Review of Outstanding Work Programme

The previous six areas of work in the UKOPA work programme are now moving to a new stage of discussion with HSE, and have now been incorporated into the list from the 13 October meeting combined with the work for the Code Supplements. These areas of work are:-

### 5.1 Failure Rate Contribution from Ground Movement.

- Final work being completed to discuss with HSE

### 5.2 Third Party Damage Predictive Model.

- To be progressed in discussions with Glynn Hawkins at Advantica

### 5.3 Mitigation – Risk Reduction Factors for Physical Protection of Pipelines.

- Various aspects being developed for inclusion in Code Supplements
- Slabbing / marker tape risk reduction now being progressed through Advantica
- Roger Ellis suggested that a distinction must be drawn between Active and Passive measures and their effects on LUP risk assessments.

### 5.4 Ethylene Pipelines – Revision of LUP zones.

- Failure rate data required (see Action 1 above), then ready to HSE discussions

### 5 Spiked Crude – Revision of LUP zones .

- Methodology being discussed and developed between BP and HSE

## 6 Gasoline Pipeline Risk Assessment.

- CONCAWE work by Rod McConnell to be issued to UKOPA and HSE.

**Action 12** – Rod McConnell to obtain UKOPA number from Phill Jones and re-issue CONCAWE Failure Rate reports to Neil Jackson and Phill Jones

- Paper to be developed for publication to described risk assessment methodology

**Action 13** – Rod McConnell to develop draft paper on Gasoline Pipeline risk assessment for consideration by UKOPA

## 6 AOB

Neil Jackson reported on the forthcoming PSG (Pipeline Safety Group) meeting on 25 November. This meeting involve 14 international members and is chaired by Mike Acton. It was agreed that cooperation and information exchange with this group should be encouraged, and that we would offer to provide them with a copy of the Advantica work on the effect of mitigating measures when it was available in return for the report they had provided to us on the first phase of the PSG Failure Frequency Analysis Effective Safety Measures Work.

**Action 14** – Neil Jackson to copy relevant parts of Ian Corder report on Depth of Cover and circulate the relevant parts to Rod McConnell.

**Action – part of Action 9** – Rod McConnell to review earlier work on developing BPD distance for gas pipelines. This is to see if a parallel can be drawn for other substances, so as to create the rationale for inner zone distances based on BPD.

**Action 15** - Rod McConnell to contact Prof. Incecik concerning the award of the UKOPA prize for Pipeline Engineering course at Newcastle University (8 December).

## 7 Next Meeting

Next meeting will be arranged by e-mail – it is expected that a date in early February should be organised with so much work now being progressed.

R A McConnell  
Draft for Comment – 26 November 2005

### RISK ASSESSMENT WORK GROUP - 23 November 2005

#### Actions from this meeting

| Action No | Action  | Owner(s)                      |
|-----------|---|-------------------------------|
| 1         | Neil Jackson to discuss Huntsman membership with Mark Harrison. Also possible membership by IDNs and HSE to be reviewed.                        | Neil Jackson                  |
| 2         | Neil Jackson to contact Jonathan Franklin to send failure rates to Rod McConnell  | Neil Jackson                  |
| 3         | Rod McConnell and Jane Haswell to devise plan and resource requirements to resolve issues raised at the WGP / HSE / UKOPA meeting on 9 October. | Rod McConnell<br>Jane Haswell |
| 4         | Rod McConnell to produce note explaining in detail the discrepancy in HSE failure rate data for small diameter                                  | Rod McConnell                 |

| Action No | Action  | Owner(s)                     |
|-----------|---|------------------------------|
|           | pipelines.  |                              |
| 5         | Rod McConnell to produce note explaining in detail the discrepancy in HSE jet fire model compared to other models and experimental data.  | Rod McConnell                |
| 6         | Neil Jackson to contact Glynn Hawkins and Advantica to set up a suitable date for such a meeting at Loughborough  | Neil Jackson                 |
| 7         | For the consequence model aspects of jet fire, it was agreed that Rod McConnell to set up a discussion with Ian Hirst, HSE Specialist Inspector responsible for the HSE Consequence Modelling. This would also allow other aspects of ethylene, spiked crude and NGL modelling to be discussed. | Rod McConnell                |
| 8         | Rod McConnell to request this Chapter of PCAG from HSE and also the index to see if other relevant sections should be obtained.   | Rod McConnell                |
| 9         | Jane Haswell and Rod McConnell to devise plan and resource requirements to resolve issues raised in the Gap Analysis for the Code Supplements.  | Jane Haswell / Rod McConnell |
| 10        | Jane Haswell and Rod McConnell to develop revised version of Code Supplements based on comments received.   | Jane Haswell / Rod McConnell |
| 11        | Neil Jackson to issue revised note on Wind Farms and issue to UKOPA membership  | Neil Jackson                 |
| 12        | Rod McConnell to obtain UKOPA number from Phill Jones and re-issue CONCAWE Failure Rate reports to Neil Jackson and Phill Jones   | Rod McConnell                |
| 13        | Rod McConnell to develop draft paper on Gasoline Pipeline risk assessment for consideration by UKOPA  | Rod McConnell                |
| 14        | Neil Jackson to copy relevant parts of Ian Corder report on Depth of Cover and circulate.   | Neil Jackson                 |
| 9         | Rod McConnell to review earlier work on developing BPD distance for gas pipelines. This is to see if a parallel can be drawn for other substances, so as to create the rationale for inner zone distances based on BPD.   | Rod McConnell                |
| 15        | Rod McConnell to contact Prof. Incecik concerning the award of the UKOPA prize for Pipeline Engineering course at Newcastle University (8 December).  | Rod McConnell                |

## RISK ASSESSMENT WORK GROUP - 23 November 2005 Outstanding Actions – Detailed Work Schedule

### 1 From Joint WGP/HSE/UKOPA Meeting 13 October 2005

| <b>Action No</b> | <b>Action</b>  | <b>Owner(s)</b>   |
|------------------|--|---|
| <b>1</b>         | <p>I Hirst would provide details of HSE's jet fire model, PIPEFIRE to R McConnell</p> <p>I Hirst and G Hawkins will provide details of the failure frequencies used by HSE to R McConnell</p> <p>I Hirst will provide details of the HSE ethylene methodology to R McConnell</p> | <p><b>R McConnell</b></p> <p><b>I Hirst</b></p> <p><b>G Hawkins</b></p> |
| <b>2</b>         | <p>HSE will consider incorporation of changes in the failure rate due to ground movement when the work commissioned by NGT is available.</p>   | <p><b>R McConnell</b></p> <p><b>G Hawkins</b></p>                       |
| <b>3</b>         | <p>HSE i) to consider use of the new mechanical damage model, and ii) review the failure rates for smaller diameter pipelines where an apparent divergence from UKOPA data had been identified by R McConnell.</p>   | <p><b>R McConnell</b></p> <p><b>G Hawkins</b></p>                       |
| <b>4</b>         | <p>HSE require further detail regarding justification of the risk reductions proposed for mitigation. This will be discussed when details of UKOPA work are available.</p>   | <p><b>UKOPA RAWG (N Jackson)</b></p>                                    |
| <b>5</b>         | <p>HSE will discuss the risk assessment methodology for ethylene with R McConnell.</p>   | <p><b>R McConnell</b></p> <p><b>I Hirst</b></p> <p><b>G Hawkins</b></p> |
| <b>6</b>         | <p>HSE will discuss the risk assessment methodology for NGL with R McConnell.</p>  | <p><b>R McConnell</b></p> <p><b>I Hirst</b></p> <p><b>G Hawkins</b></p> |
| <b>7</b>         | <p>A formal comparison of the HSE mechanical damage prediction model and the UKOPA mechanical damage limit state is to be carried out.</p>   | <p><b>G Hawkins</b></p> <p><b>J Haswell</b></p>                         |
| <b>8</b>         | <p>HSE to give internal consideration to submitting the UKOPA paper to the Cabinet Office for consideration as part of the current review of societal risk issues.</p>   | <p><b>M Wilson</b></p> <p><b>N Riley</b></p>                            |
| <b>9</b>         | <p>HSE HID CI5 to provide technical comment on societal risk methodology/FN criteria, separate from the process to be applied to the joint technical agenda on risk assessment.</p>  | <p><b>N Riley</b></p> <p><b>P Harper</b></p> <p><b>R McConnell</b></p>  |

| <b>Action No</b> | <b>Action</b>  | <b>Owner(s)</b>  |
|------------------|--|--|
| <b>10</b>        | HSE HID CI5 will review external work on depth of cover or pipeline protection, external work would be reviewed, and may recommend changes to the HSE methodology if the evidence was sufficiently strong.   | <b>UKOPA RAWG<br/>(N Jackson)</b>                      |
| <b>11</b>        | UKOPA to provide reports on application of the UKOPA Pipeline Fault Database to all pipelines and review of CONCAWE data to HSE, and discuss with HSE application of data to new and old pipelines.  | <b>UKOPA RAWG<br/>(N Jackson)<br/><br/>G Hawkins</b>   |
| <b>12</b>        | Arrange meeting(s) to discuss actions 1 – 6.   | <b>R McConnell<br/><br/>I Hirst<br/><br/>G Hawkins</b> |
| <b>13</b>        | List documents to be exchanged between HSE and UKOPA   | <b>J Haswell</b>                                       |
| <b>14</b>        | NG/Advantica to review available experimental test data for jet fires and forward any relevant data to HSE   | <b>N Jackson<br/><br/>P Baldwin<br/><br/>I Hirst</b>   |
| <b>15</b>        | Formal review of technical basis for the TD/1 BPDs for the purpose of deriving a technically equivalent distance for non-natural gas pipelines.  | <b>UKOPA RAWG<br/>(N Jackson)</b>                      |
| <b>16</b>        | Draft and circulate Terms of Reference for Expert UKOPA/HSE Meetings, covering i) the topics for joint working/discussion, ii) the procedure for setting up and recording meetings, and iii) the procedure for agreeing and formalising action programmes and timescales, for approval by WGP. | <b>R McConnell</b>                                     |

## 2 From 20 October Special Meeting to Review Code Supplements

| <b>Action No</b> | <b>Action</b>  | <b>Owner(s)</b>   |
|------------------|--|---|
| <b>1</b>         | <p><b>Code supplements to be reformatted and restructured to:</b></p> <ul style="list-style-type: none"> <li>i) Explain purpose and link to main code requirements for new pipelines</li> <li>ii) Include detailed guidance based on expert best practice</li> <li>iii) Include key failure frequency data</li> <li>iii) Incorporate all comments received to date</li> <li>iv) Include benchmark solutions as an appendix; benchmark solutions to include: <ul style="list-style-type: none"> <li>• application of HSE methodology to design case pipelines and explanation of any differences between HSE approach and expert best practice approach</li> <li>• Use of risk reduction factors</li> </ul> </li> </ul> | <p><b>Jane Haswell<br/>+<br/>Rod McConnell</b></p>          |
| <b>2</b>         | <p><b>Justification for Depth of Cover:</b></p> <p>Advantica report to be reviewed and made available if possible.</p>   | <p><b>Neil Jackson</b></p>                                  |
| <b>3</b>         | <p><b>Justification for Slabbing and Marker Tape</b></p> <p>Recent Advantica review, papers by Gas de France and work by N Jackson and R McConnell to be reviewed, and considered for collation into justification paper</p>   | <p><b>Neil Jackson /<br/>Mike Acton<br/>+ Advantica</b></p> |
| <b>4</b>         | <p><b>Risk Calculation</b></p> <ul style="list-style-type: none"> <li>i) Description of construction of individual risk transect from hazard distance to be developed for inclusion in supplement.</li> <li>ii) Description of construction of site specific FN curve to be reviewed and expanded if required.</li> </ul>  | <p><b>Rod McConnell</b></p>                                 |

### 3 From 20 October Gap Analysis applied to Review Code Supplements

| <b>Action No</b> | <b>Action</b>  | <b>Owner(s)</b>                     |
|------------------|--|-------------------------------------|
| 1                | Priority Red - Corrosion Failure Rate - all substances<br>Further assessment of fault data required, in particular to assess recent improvement in incidence rates   | <b>Who?</b>                         |
| 2                | Priority Red - Corrosion Failure Rate - Ethylene<br>Reported external corrosion faults high - details of individual reports to be requested, reports to be reviewed and assessed - data requested from Advantica, analysis of corrosion faults then required to assess explanation + statistical significance of differences | <b>Jane Haswell / Rod McConnell</b> |
| 3                | Priority Red - Mechanical Failure Rate - all substances<br>Further assessment of fault data required to assess relevant improvements in incidence rates due to welding, NDT etc.   | <b>Who?</b>                         |
| 4                | Priority Red - Ground Movement - Natural Gas<br>Results of NGT contract work to be assessed and interpreted  | <b>Neil Jackson / Jane Haswell</b>  |
| 5                | Priority Red - Ground Movement - Other substances<br>Interpretation of NGT contract work to be considered for application.<br>J Haswell to draft method for assessment of susceptible zones to based on BGS descriptions developed for NGT.  | <b>Jane Haswell</b>                 |
| 6                | Priority Red - Release Rates - Spiked Crude<br>UCL developing method under BP sponsorship.   | <b>BP</b>                           |
| 7                | Priority Red - Consequences - Jet Fire - Natural gas<br>Further discussion required (see actions above)  | <b>Rod McConnell / Ian Hirst</b>    |
| 8                | Priority Red - Consequences - Jet Fire - NGL<br>A D Little assumptions applied to Shell report to be checked. Advantica requested to advise.   | <b>Mike Acton</b>                   |
| 9                | Priority Red - Mitigation - Slabbing & Marker Tape<br>EBP Recommendation - reduction to 0.1 for slabbing + marker tape, justification paper required to support this. N Jackson to request that Advantica review all available information and prepare justification report for UKOPA.                                       | <b>Neil Jackson / Advantica</b>     |
| 10               | Priority Yellow - Ignition - Natural Gas<br>Assumptions for R Area agreed. M Acton to advise if different assumptions should be applied to S Areas.  | <b>Mike Acton</b>                   |

| <b>Action No</b> | <b>Action</b>   | <b>Owner(s)</b>                   |
|------------------|---|-----------------------------------|
| <b>11</b>        | Priority Yellow – Ignition – NGL<br>R McConnell to check assumptions in A D Little report and used by HSE. M Acton to discuss with P Cleaver.   | <b>Rod McConnell / Mike Acton</b> |
| <b>12</b>        | Priority Yellow – Flash Fire – Other than Nat Gas<br>Recommendation - code supplement to state that dispersion vs distance model needed, high level guidance on how this information should be used to be drafted by R McConnell. | <b>Rod McConnell</b>              |
| <b>13</b>        | Priority Yellow – Calculating Individual Risk<br>R McConnell to draft text on construction of risk transect from hazards zone (extension to existing TD1 App 3 text).   | <b>Rod McConnell</b>              |
| <b>14</b>        | Priority Yellow – Depth of Cover<br>Advantica have completed recent review. M Acton to advise whether report can be supplied to UKOPA   | <b>Mike Acton / Neil Jackson</b>  |
| <b>15</b>        | Priority Yellow – Mitigation – Slabbing & Marker Tape<br>Comments on additional, equivalent protection methods to be included in code supplement – i.e. sleeving, steel slabs   | <b>Who?</b>                       |