ACDS MHSC Working Group on Pipelines

Notes of Gasoline Technical Meeting held on 25th November 2003 at ABB Offices, Daresbury

Attendance:

G P Walker	Chairman
P Davis	UKOPA/BPA
R Ellis	UKOPA/Shell
R McConnell	Independent/ABB
P Sargent	HSE Policy Unit
M Goose	HSE MSDU
J Vardon	Oil & Pipeline Agency
N Macnaughton	BP
R White	TOTAL (UK) Ltd
W Hughes	Esso
G Knight	Esso
J Haswell	UKOPA/Secretary

Apologies:

M Harrison	UKOPA/Huntsman
P Brown	UKOPA/Transco
S Chatfield	HSE HID

1 Welcome and Introduction

G Walker welcomed everyone to the meeting and briefly outlined the purpose to discuss the proposed reclassification of gasoline pipelines as major accident hazard pipelines in the amendments to PSR 1996. He stated that the meeting would commence with presentations by P Davis (historical review), P Sargent (PSR amendments), M Goose (HSE position) and R McConnell (industry review). Following this, there would be open discussion on issues raised in the presentations to allow actions to progress to be identified.

2 Historical Review of Consultant Process

P Davis presented a brief summary of the previous consultation on gasoline pipelines which commenced pre-1996. (Presentation is included as Attachment 1).

Key concerns raised by Industry at the time were the need to establish the risk assessment methodology for gasoline pipelines, inaccuracies of the 'flat earth models' , the need to reflect the safe record of gasoline pipeline operation within the UK, the changes in perception associated with the categorisation of 'dangerous'. He stressed that Industry had always supported the formalisation of good practice issues such as the use of formal safety management systems, preparation of MAPDs, and the preparation and testing of emergency plans and procedures.

The key concern however is the associated LUP issues which will arise. Once the pipelines are notified as MAHPs, Local Authorities will require consultation distances (CDs) for planning purposes. Most gasoline pipelines are over 30 years old and a significant amount of development has been allowed to occur close to the pipeline routes. In this respect, Operators also consider difficulties could arise from the public perception of the reclassification of these pipelines into a "dangerous" category.

The risk assessment carried out by A D Little highlighted that the risk level of gasoline pipelines was borderline in terms of tolerability. The cost benefit analysis that was carried out during the consultation identified costs associated with the regulatory change to be between £52 and £104

million over 40 years. The high costs resulted primarily from LUP issues. The borderline risk, together with the high costs, prompted ACDS to action detailed consultation. An informal Pipeline Working Group comprising HSE and Industry representatives was formed to address ACDS concerns. This Group developed a document entitled "The Way Forward" which recommended that gasoline be reclassified under PSR but be excluded from land use planning requirements. "The Way Forward" document was not accepted by HSE who actioned further risk assessment, carried out by W S Atkins and reported in 1998. This work identified that the majority of incidents associated with gasoline pipelines had all occurred outside Europe, the majority in the USA, South America and South Africa. HSE then prepared an internal response to the work. This effectively terminated the detailed consultation without establishing a joint view. The matter was referred to ACDS, and HSE proposed that a formal Working Group reporting to the MHSC be formed and charged with the responsibility to resolve how the marginal risk level is addressed, taking into account the severity of the consequences arising from low frequency events.

P Davis concluded by stating that following the issue of new guidelines regarding Regulatory Impact Assessments (RIAs) by the Treasury, HSE had removed the costs of LUP from the original CBA on the basis that these costs were not borne by society.

Points of clarification:-

J Vardon stated that with respect to the RIA, any costs occurring in relation to the Government pipelines operated by OPA will be borne by the taxpayer and are therefore clearly a societal cost and should be included in the RIA.

3 Amendments to PSR

P Sargent stated that in his current position his main areas of work are progressing amendments to PSR 96 and the key priorities are:

i) Amendments covering gas mains replacement which are now complete.
ii) The reclassification of gasoline pipelines as MAHPs.
iii) Testing of and charging for Pipeline Emergency Plans.

P Sargent stated that the decision regarding the reclassification of gasoline has been made and discussions were now needed to identify how the regulatory requirement can be practically implemented. The key purpose of the meeting was to consider the practical implementation specifically associated with risk assessment and the determination of consultation distances (CDs). He emphasised that his priority was that the meeting would progress understanding and agreement of how to deal with these issues and stated that the programme for the amendment would depend on actions identified at this meeting.

Once these actions were completed, he anticipated it would take 3-4 months to prepare the formal consultation document and a 3 month consultation period would be required once this was published. In principle, he felt that the amendment could be implemented by the end of 2004.

Points of clarification:-

N Macnaughton requested clarification of the definition of gasoline and whether the scope of the amendments apply to multi-product pipelines.

P Sargent confirmed the scope would apply to multi-product pipelines and that the definition of gasoline would be set out in the formal consultation document. P Davis noted that the original consultation had considered in detail the chemical composition and product mix which is generically referred to as gasoline, and that a definition covering this was included in the original consultation document.

R Ellis stated that the definition of dangerous fluid could have a wider impact, particularly at large refineries and chemical process plants, and asked how this is to be addressed.

M Goose stated that gasoline was not a chemically fixed product and HSE would therefore assume the 'worst in class' in any advice that they provided. He also noted that the definition of gasoline is a recognised problem on COMAH sites.

R Ellis asked if the definition will be driven by European views.

P Sargent stated that PSR will concentrate on UK issues but must take into account the content of the European Pipeline Directive.

G Walker asked whether the definition of gasoline fundamentally affected the current discussion on pipeline risk assessment methodology.

It was agreed the definition was not fundamental to the current discussion.

4 Land Use Planning around Gasoline Pipelines

M Goose presented HSE's current views on land use planning issues associated with gasoline pipelines (Presentation included as Attachment 2).

M Goose stated that the HSE Policy Group has an established view which dates from the work carried out in 1999. This view takes into account the land use planning duties, the incident history of gasoline pipelines, the ACDS / HSE decision to reclassify pipelines, and the requirement to implement these changes to PSR taking account of the European view. He noted that from the European perspective there is now more interest in gasoline than existed 10 years ago when the initial consultation started. P Davis noted that this is due to environmental issues as the European Pipeline Directive is biased towards environmental concerns. P Sargent acknowledged this, noting that changes had occurred in COMAH due to environmental pressures.

M Goose moved on to consider the difference in the role of the assessments carried out by PSR duty-holders and HSE. For the PSR duty-holder, the role is for demonstration of prevention, control and mitigation. For HSE as a consultee on planning issues, the role is for assessment of mitigation only. As the roles are different, it is appropriate to apply different assessment methods. He stressed that in terms of LUP advice, HSE look solely at the risks that remain to people in the vicinity of a major accident hazard and there is no attempt to control the number of people in this vicinity. This puts pressure on Industry, who are then required to implement additional mitigation and are not protected against encroachments.

Regarding the incident history of gasoline pipelines, M Goose acknowledged that many of the incidents covered in the background reports were from the United States. This was because the American authorities are very good at publishing results of investigations. HSE make it widely known that they rely on the North American Transportation Safety Board archive as a key source of reference material. If operational frequency data is to be used, the integrity of the data reporting is very important. He noted that where doubt exists regarding the data, the HSE R2P2 document states that more weight should be given to consequence. For this reason, most assessments of gasoline pipelines are consequence based. R McConnell contested this, noting that the W S Atkins report quoted 350 incidents which provided a good population of well recorded data. M Goose acknowledged that historical incidents can be used to derive failure frequency data but he noted that such data may not necessarily apply along the length of a pipeline over which conditions vary.

Note - Access to reference material was discussed. M Goose confirmed the Atkins report (036/2002) was published and should be available from the HSE website. He agreed to provide hard copies to the Working Group on Pipelines if possible as an electronic .pdf file.

Action M Goose

Regarding the type of assessment, M Goose stated that a major difference between assessments required for COMAH or PSR compliance and LUP advice was that the former present current risks, while the latter considers the risks which could exist over a future period (for example 20 years) if

the development is progressed. He confirmed that the HSE assessment is carried out using HSE software, Pipeline RISKAT which incorporates PIPERS and MISHAP developments.

M Goose then considered how land use planning controls work. The HSE PADHI (Planning Advice for Hazardous Installations) was based on prescriptive policy and was not established to consider specific or marginal risk cases. He stressed that PADHI advice is an administrative process carried out by the local HSE HID offices (ie object / not object). The longer term intent was to move this administration process into the Local Authority Planners' Offices. He stressed that in terms of land use planning decisions, HSE input is not dominant, however he did note that if the planning decision goes against HSE advice, HSE can call the decision to public enquiry.

M Goose summarised the three main options for the assessment of gasoline pipelines as generic, intermediate (ie flat earth, HSE's preferred approach) and full topographic.

The generic approach is informed by risk assessment but is not based on a specific pipeline risk assessment. In general it does not give the depth of advice required by local planning authorities and would therefore require LPAs to obtain advice from independent consultants. In 98/99, MSDU (P Wright) prepared a technical advice paper based on a peer review which identified an inner risk distance of 50 metres and an outer distance of 60 metres for all gasoline pipeline diameters up to 16", implying there is no inner zone.

The intermediate approach (based on PIPERS) is risk-based but does not model local topography. It provides a broad assessment, not an accurate local prediction, and is similar to that applied to fixed sites.

The full topographic assessment model, if adopted, could result in a duty on Operators to monitor and notify environmental changes in the vicinity of pipelines. This was likely to be a costly option for Operators.

M Goose stated that HSE's preferred option was the intermediate approach using the flat earth model. The notification information needed for this approach is pipeline diameter, wall thickness, material type, maximum operating pressure and the location of pumping stations. HSE would only review detailed data associated with the pipeline route if an enquiry is rejected.

M Goose then summarised possible generic land use planning zones as presented in the 1996 A D Little report for four pipeline diameters as:

	Middle Zone	**Outer Zone**
Largest	78m	104m
Mid –Range	45m	80m

It was proposed that Inner Zones could be based on pool radius, way-leave or MBD.

The internal review carried out by HSE came to the conclusion these distances were too large and hence recommended the distances of 50 metres and 60 metres noted earlier. In terms of any assessment, M Goose stated that the uncertainty of the analysis should be considered and results modified accordingly. He stated that a factor of 2 is likely to be relevant to consequence predictions, whereas a factor of 10 is more appropriate for frequency data.

P Davis noted that with respect to assessment of marginal risk levels, this approach was problematic as the advice provided was essentially yes or no. M Goose acknowledged this and stated that HSE's intent was to apply uncertain techniques as consistently as possible. He noted that HSE takes the marginal case into consideration by looking in detail at the distance of the proposed development from the pipeline.

In conclusion, M Goose stated that HSE will advocate the use of the intermediate model (PIPERS) with specified inputs and assumptions. In this respect, he noted that HSE will account for mitigation for certain factors only, depending on whether the factor was a mandatory requirement and is confirmed as permanent.

Points of clarification:-

J Vardon stated that the inputs and assumptions would need to be in place before the amendment is enacted.

M Goose stated this was not necessary, the enactment could be used to gain experience on the practicality on the approach required.

P Davis noted that the ACDS decision to support the proposed reclassification of gasoline is dependent on achieving agreement on the approach to risk assessment and CDs and confirmation that the marginal case is dealt with.

M Goose stated he was not aware of the details of the ACDS decision.

5 Review of Gasoline Pipeline QRA

R McConnell had circulated a detailed paper prior to the meeting and presented a summary of the key findings of the independent review to identify and compare inner, middle and outer zone consultation distances for gasoline pipelines. (Presentation included as Attachment 3).

R McConnell stated that the review had covered three prime references: W S Atkins 1998, A D Little 1996 and HSE Gasoline Pipeline Risk Assessment 1999. Of these reports, the W S Atkins report presented an extensive review of both incident history and modelling, and clearly showed risk levels of gasoline pipelines to be below the threshold for land use planning. It included an extensive review of actual incidents, and had identified that relatively few gasoline releases ignite, and that relatively few releases result in large pools as most leaks soak into the soil.

R McConnell presented the results of the review, covering:

i) Failure rate data
ii) Release rate data
iii) Event trees (urban and rural)
iv) Ignition data
v) Pool size based on incident data
vi) Ground soak-in
vii) Fatality assumptions
viii) Consequences – size and radiation from pool and spray fires

R McConnell had used information obtained from the review to identify the methodologies used by A D Little, W S Atkins and HSE, and had then constructed models and validated the predictions obtained. He used the models to investigate the sensitivity of risk predictions to the various assumptions, and to compare the A D Little, W S Atkins and HSE methodologies. The results of the studies confirmed that the key factors affecting the predicted risk are the rate of release, the pool size and the escape speed of people once ignition has occurred. R McConnell noted that in contrast to gas pipelines in which the total risk is dominated by pipeline rupture, for gasoline pipelines only 51% total risk level is due to rupture, 49% is due to holes and a significant proportion of this is due to what is defined as a pinhole.

R McConnell presented the main conclusions as follows:

- W S Atkins indicates a high level of escape from spreading gasoline pools based on worldwide experience and the timescale for pool spreading – this factor is over-estimated in other assessments.

- A D Little over-estimated pool fire radiation effects and under-estimated permeability of soil.

- HSE assume non-permeable soil, and 24 hr spreading pool from a pinhole leak which then has delayed ignition, which dominates the risk level predicted.

- All assessments use non-UK pipeline failure rates with significant factors of conservatism.

Points of Clarification

G Walker requested R McConnell to summarise the primary factors which would affect risk predictions obtained using the intermediate approach.

R McConnell stated that the key factor affecting the risk level is consequence modelling not frequency modelling, and in terms of consequence modelling the main factors affecting the prediction are soil permeability, pool diameter, the timescale for the pool to develop and the escape speed. He noted that the major contribution to the prediction of total risk level was the 100m pool occurring from a leak from a 10mm diameter pinhole over 24 hrs with delayed ignition.

6 Discussion

G Walker thanked P Davis, M Goose and R McConnell for the presentations and requested that the key items be identified to structure the discussion.

The list of items for discussion was agreed as:

i. The 100 metre diameter pool size, the size of a pin hole and the time for pool development.
ii. The rate of leak (including loss of energy), the hydraulic gradient and the MOP at the leak location.
iii. Soil permeability.
iv. Escape factor.
v. Multi-product pipelines.

G Walker proposed that the discussion of all topics should concentrate on their impact on the intermediate model.

- Soil Permeability

  It was noted and acknowledged that soil permeability assumptions have a major impact on the consequence modelling primarily as they limit the size of the pool which can develop. M Goose confirmed that soil permeability was not taken into account by HSE when providing LUP advice as ground permeability will change as a result of development.

  J Vardon, P Davis and R Ellis all emphasised that some degree of permeability must be included, not to do so is impracticable.

  M Goose emphasised that HSE's approach when dealing with highly variable assumptions was to apply a cautious best estimate and, in this case, this was zero permeability.

  G Walker noted that soil data varies considerably on a site by site basis but that it is clearly very influential. He noted that this was a highly controversial issue, and further progress during the current discussion was unlikely.

  G Walker proposed that HSE give further consideration to the use of an "average or typical soil permeability".

  Action M Goose

- 100 Metre Diameter Pool Size, Size of Pin Hole and Time for Pool Development

  M Goose stated that HSE's approach was to model the maximum pool size but to cap this at 100 metres diameter. R McConnell noted the assumption that this pool can develop from a small leak over a 24 hour period had a major impact on the total risk level prediction. This assumption was discussed in detail and generally considered to be impractical.

M Goose agreed this was likely to be incorrect and would investigate how PIPERS modelled the leak rate and pool size development.

Action M Goose

M Goose stated that HSE model only 30 minutes of event time, after which it is assumed the Emergency Plan is activated. The 30 minutes start at the time when people are affected, eg the time at which the gasoline pool ignites.

R McConnell noted that the Atkins report had discredited the 100 metre pool size. M Goose acknowledged this but stated that HSE do not attempt to model reality. He agreed to consider the possibility of changing the cap on pool size to 30 metres diameter.

Action M Goose

R McConnell stated that the clarification of technical modelling points such as the above could quickly and efficiently be addressed through the Working Party (Risk Assessment) and made a direct plea to M Goose to support its reformation. He emphasised that the resource commitment required was limited to the time for face to face discussions only, which would be scheduled for Bootle to reduce the time to a minimum. R Ellis and P Davis strongly supported this request. M Goose stated that this was not possible.

M Goose stated that the assessments carried out by MSDU involved a complete approach, ie the type of model applied, the depth of the analysis, the criteria used for the assessment, the application of the cautious best estimate approach and the identification of factors for which mitigation credit is given.

J Vardon stated Operators understand HSE's overall approach but emphasised that the assumptions made need to be transparent.

Size of Pin Hole:

This issue generated significant discussion. It was stated and agreed that a 10mm hole could not be considered a pin hole and therefore the event scenario which started with the 'pin hole leak' was not credible. P Davis noted that CONCAWE data is dominated by pin hole corrosion leaks which have occurred in lagged hot oil pipeline systems. The application of this data to all pipelines was clearly incorrect.

M Goose stated that this issue may be due to partitioning of data, and noted that where data quality was not defined, it is necessary to take a cautious approach biased towards safety. Operators confirmed the need to understand what is being done and the details of the assumptions applied so that it was possible to take a view on the level of caution being applied.

R McConnell noted that the 100 metre diameter pool resulting from a leak from a 10mm hole over a 24 hour period underpinned the total risk level prediction for gasoline pipelines, in that more than 50% of the total risk prediction for gasoline pipelines is due to this scenario.

P Davis stated that more detail on the CONCAWE incident data could be provided, M Goose agreed to review this.

Action M Goose

R McConnell again noted that in terms of gasoline risk level predictions, frequencies are second order, the primary factor is the modelling consequences.

- Escape Factor

  Escape factor and aspects of human behaviour were discussed in some detail (ie staying to observe an accident versus escaping from the consequences of an accident). P Davis and J

Vardon commented that the HSE approach tended to treat the pipeline accidents as if they occurred on fixed sites, whereas Operator experience is that, in general, public response to leaks and spillages tends to be very cautious and there are a large number of false reports. The discussion identified the significantly differing view between HSE and Industry. The modelling of this aspect is highly judgemental. M Goose stated that quoting evidence of specific incidence was not necessarily a good indication but that HSE would review the results of any study undertaken by Industry.

Action M Goose

- Rate of Leak

It was agreed in hydraulic pipelines, rapid energy loss occurs with any leak and the leak rate reduces very quickly. Most models do not accommodate this. M Goose confirmed HSE do not model time varying flow rates. The use of flow monitoring and leak detection systems for mitigation was considered. M Goose stated that credit for leak detection systems as mitigation was unlikely as these systems varied significantly in sophistication and were not mandatory. He emphasised again that in order to allow credit, HSE requires evidence of permanence. In this respect gas detection and remote shut-off systems were not seen as permanent. M Goose agreed to discuss the approach to modelling with HSE Pipeline Inspectors.

Action M Goose.

Hydraulic Gradient:

Modelling of hydraulic gradient in terms of varying MOP versus constant pressure due to lock-in of pressure was considered. It was noted that most releases were assumed to occur at maximum pressure. In general Operators considered the probability of this occurring was very low and that this probability should be modelled. M Goose stated that in assessments, HSE take notification particulars, not specific operating conditions in modelling the pipeline. He confirmed that if a pipeline was notified with variable design factor and MOP, this could be taken into account. P Davis commented that if all issues are assumed to occur as a worst case, the assessment becomes unrealistic.

- Multi-product Pipelines

M Goose confirmed that the probability of the most hazardous product being present is not usually taken into account when giving land use planning advice, as the most hazardous product only is assumed. He noted that if a concession was made to limit this assumption any such concession would need to be policed and it was unlikely the local authorities would undertake this requirement.

J Vardon observed that the assumptions applied were not transparent, the approach was not clear and did not provide a convincing case for pipeline safety. He felt that issues should be separated into a factual component and the level of conservatism applied.

Summary and Conclusions:

G Walker summarised the discussion, noting that several issues had been identified and M Goose had agreed to obtain an HSE view and provide a response so continuing discussion / dialogue was required.

G Walker noted that M Goose had confirmed that the Working Party could not reform on a minimum basis at this stage, and proposed that the interface must occur through the fundamental review project. He noted that the WGP was attempting to establish a joint HSE / Industry working relationship through Projects P5 and P6 of the Fundamental Review but the timescale for delivery would be an issue.

M Goose advised that the discussions on gasoline should occur independently, as the Fundamental Review project was considering the risk assessment process and modelling, whereas the gasoline issue centred on the specification of the CDs.

G Walker stated that a process for resolution of the issues identified and resources to carry the process were required. He noted that as the Working Party was no longer in existence, the way forward may involve working through papers, prepared jointly by HSE and Industry, or otherwise by Industry. He noted also that the meeting had identified that the outcome of any review carried out by HSE must be transparent and understood.

A number of options were considered and the following actions were agreed:

R McConnell to clarify technical points with HSE and prepare paper presenting position and understanding achieved as a result of the discussions at the Technical Meeting.

Action R McConnell

M Goose to arrange HSE MSDU review meeting with representation from pipeline inspector (A Thayne) and WGP (R McConnell).

Action M Goose

WGP to specify and progress a quantitative evaluation of factors which impact on risk predictions, and the differences between the different approaches to assessment.

Action WGP

G Walker closed the meeting by thanking all for their contributions to the discussion and their support for and interest in achieving a constructive resolution of the issues.