From:	Mcdonald, Andy
To:	York Potash Harbour
Subject:	151216 TR030002 CATS Parties - Statement of difference and Young Lady Report
Date:	16 December 2015 22:02:51
Attachments:	Statement of difference.pdf YoungLadyReport.pdf

Dear Sirs

Please find attached a submission by the CATS Parties in response to the examining authority's Rule 17 letter dated 25 November 2015.

Please note that BP, as the existing CATS Operator, recently transferred its interest in CATS from Amoco (U.K.) Exploration Company, LLC to CATS North Sea Limited. With effect from 17 December 2015, control of CATS North Sea Limited will transfer to Antin Infrastructure Partners ("Antin"). All previous objections representations and correspondence from or referring to Amoco (U.K.) Exploration Company, LLC should be read by the Examining Authority in examining the above Order as being from, or referring to, CATS North Sea Limited. Antin have been involved in, and approved, the terms of the attached submission.

Please note that all further communications on this subject sent to CATS Parties should be sent to the address below:

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I will send a hard copy of this submission in the post. Please confirm receipt of this email.

Regards

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APPLICATION BY YORK POTASH LIMITED FOR A DEVELOPMENT CONSENT ORDER FOR THE YORK POTASH HARBOUR FACILITIES ORDER

STATEMENT OF DIFFERENCE

ON BEHALF OF

THE CATS PARTIES

1 INTRODUCTION

1.1 This submission is made by the CATS Parties in response to the examining authority's Rule 17 letter dated 25 November 2015.

1.2 The examining inspector asked the CATS Parties and the applicant to reach agreement on the appropriate redaction of the CATS Parties' risk assessment and for a Statement of Difference to be provided.

1.3 This submission sets out the CATS Parties' position on the following:

1.3.1 Matters in relation to conveyor alignment selection;

1.3.2 Matters in agreement with the applicant;

1.3.3 Matters not agreed between the CATS Parties and the applicant;

1.3.4 The severity of a major incident;

1.3.5 The operational impacts of an incident on the CATS pipeline

1.3.6 Further detail on the CATS Parties' Quantative Risk Assessment (QRA) position following discussions with the applicant.

2 OVERVIEW

2.1 The CATS Parties wish to make clear, as they have previously, that they do not oppose the York Potash development (the Proposed Development) in principle, and their concerns relate to the route alignment for the conveyor belt.

2.2 The applicants have put forward two preferred alignments for the route of the conveyor, the northern and southern alignments. The southern alignment requires a significant amount of oversailing of the CATS pipeline. The CATS Parties oppose the southern alignment, and support the granting of the DCO for the Proposed Development with the northern alignment.

2.3 In this respect, it is important to note that there is no suggestion from the applicant that using their northern alignment would prevent the benefits of the Proposed Development being realised. Indeed, it is clear from the applicant's own documents that the northern alignment is as able to secure the benefits of the project as the southern alignment.

2.4 However, it is also clear from the application documents that the southern alignment has been identified because of its potential operational benefits to the applicant. The applicant's limited assessment between the two alignments has not taken into account the potential impacts (safety, operational or economic) on other users, including the CATS Parties.

2.5 Whilst the level of risk is not agreed, it is common ground between the CATS Parties and the applicant that the southern alignment introduces a higher level of risk than the northern alignment.

2.6 It is also not disputed that the southern alignment will result in a far greater number of interactions between the proposed development and the CATS pipeline when compared with the northern alignment.

2.7 Insofar as the southern alignment may offer benefits to the applicant, these were stated in general terms and have not been quantified. As noted above, it is the applicant's position that the benefits of the Potash development will be secured using either alignment. Against this background, and taking into account the potential impacts, in terms of health and safety, operational and economic impacts, the applicants have failed to put forward sufficient justification for the higher risk of the southern alignment to be accepted in preference to the northern alignment.

3 MATTERS AGREED AND NOT AGREED WITH THE APPLICANT

3.1 A meeting was held between the CATS Operator, York Potash Ltd (YPL) and its contractor, Royal Haskoning DHV on 4th December 2015 to review the summary of the Quantitative Risk Assessment (QRA) for the potential routing options of the overland conveyor, submitted to the Planning Inspector on 24th November by the CATS Parties. The matters agreed/not agreed are as follows:

3.2 Matters agreed:

3.2.1 Method of assessment – Fault Tree analysis was appropriate;

3.2.2 Base input information (statistics, references used to look at probability and sources of case information) were appropriate except for the risk presented by vehicle movements in the pipeline corridor;

3.2.3 Base human error rate of 0.001 per opportunity; and

3.2.4 Risk presented by the southern alignment is greater than the northern alignment.

3.3 The following areas were not agreed:

3.3.1 The principle of inherent safety in design and the application of the 'Hierarchy of Control' to risk mitigation;

3.3.2 Intolerability of the risk presented by the southern alignment;

3.3.3 The level of risk mitigation that can be claimed for administrative controls (in the form of the protective provisions);

3.3.4 The impact of over familiarisation and normalisation of risk on human error rate for repetitive activities; and

3.3.5 Base input information with respect to the risk presented by vehicle movements in the pipeline corridor.

4 ROUTE SELECTION

4.1 The applicant has produced an Option Study Report which assessed a total of 10 alignments for the overland conveyor. Paragraphs 3.3.13 to 3.3.20 of the Environmental Statement (document 6.6) set out the assessment undertaken by the applicant when identifying acceptable alignments.

4.2 It was only following this detailed assessment that the applicant concluded that both the southern alignment and the northern alignment would be acceptable.

4.3 It should be noted that in section 5.1 of the applicant's Option Study Report, one of the "significant challenges" in identifying an acceptable alignment was stated as "numerous buried pipelines which have strict rules regarding proximity to construction of other infrastructure".

4.4 Section 3 of the Option Study Report notes that the southern alignment contained significant existing third party infrastructure including buried pipelines. The existence of this infrastructure was identified by the applicant as requiring significant work to confirm the feasibility of the southern alignment. It was due to concerns regarding the feasibility of the southern alignment that the northern alignment was identified. The conclusion to the Option Study Report confirms that the northern alignment is feasible but regarded by the applicant as "less desirable from an operations perspective than the southern alignment".

4.5 The benefits of the Proposed Development have been stated by the applicant in various documents including the Statement of Reasons to the Compulsory Purchase Order (document 5.1 - paragraphs 4.15 – 4.28). This details the significant economic benefits to the local area and wider UK economy as well as the job creation benefits of the Potash development. It is noted that these benefits are stated as deriving from the scheme and no distinction is made between a scheme with the southern or northern alignment. Moreover, the applicant's position is that the compelling case in the public interest for the scheme exists for both the southern and northern alignments.

4.6 It is clear that the northern alignment will deliver materially the same benefits as the southern alignment and nowhere in the application documents is any attempt made to quantify the applicant's preference for the southern alignment over the northern alignment. It is submitted that this is relevant when considering the impacts of the southern alignment on the CATS Parties, both in terms of matters of health and safety and operational/economic impacts.

5 SEVERITY OF IMPACTS

5.1 This section provides further detail on the severity of an impact were there to be a breach of the CATS pipeline.

5.2 The Government agency, Centre for Protection of National Infrastructure (CPNI), sets limits on the amount and type of information that can be put into the public domain about nationally critical infrastructure.

5.3 CPNI categorises infrastructure according to its value or "criticality" and the impact of its loss. This categorisation is done using the Government "Criticality Scale", which assigns categories for different degrees of severity of impact. The CATS pipeline is classed as "critical infrastructure" (its categorisation is confidential).

5.4 Given the restrictions that apply to the release of information, this submission does not contain precise details on the severity of a full-bore rupture of the CATS pipeline, but is considered sufficient to enable an informed view to be taken on this issue.

5.5 As stated in previous submissions, the CATS pipeline operates at 120 barg, which is approximately sixty times that of the domestic gas supply distribution network. Due to the nature of the construction activities required for the proposed development, a full-bore rupture has been assessed as a credible outcome if the pipeline is impacted as a result of an error. Furthermore, a source of ignition is probable as a result of the general construction environment. Therefore, a gas release from the CATS pipeline has a high probability of finding a source of ignition.

5.6 Calculations completed by the CATS Parties have indicated that the hazardous contours that present a danger to life from a full-bore rupture of the CATS pipeline extend for several hundred metres from the impact site. The impacted populations for the southern alignment were identified as including a) the applicant and their contractors, b) the Tesco Distribution Warehouse, c) the Car Distribution Centre, and d) the Bransands Sewerage Works. The population total is well in excess of the R2P2 threshold population of 50.

5.7 The opinion of the independently led Hazard Identification (HAZID) study was that the southern alignment would exceed the tolerability threshold in R2P2 and would be classed as "intolerable". The northern alignment has been assessed by the CATS Parties and the applicant as below the relevant threshold.

5.8 Whilst the prospect of a full bore rupture and ignition are considered limited, they are still above the relevant threshold for a 50+ plus fatality event.

6 OPERATIONAL IMPACT

6.1 The submissions of the CATS Parties on the route alignment have thus far focused on matters of safety. There is also a significant and credible operational risk presented by the Proposed Development to the CATS pipeline.

6.2 The Protective Provisions (PPs) in Schedule 9 of the Development Consent Order (DCO) require the applicant to immediately notify the CATS Parties of any damage to the CATS pipeline. This would be required in the event of any contact with the CATS pipeline during piling or excavation activities or dropped loads in the vicinity of the CATS pipeline.

6.3 The CATS Pipeline is a "Major Accident Hazard Pipeline" as defined by Pipelines Safety Regulations 1996. These Regulations place certain obligations on the CATS Parties, including an obligation not to permit conveyance of fluids in the pipeline unless adequate arrangements have been put in place to deal with a defect or damage affecting the pipeline. The CATS Parties have considered the actions that would need to be followed were there to be actual or suspected impacts with the CATS pipeline during construction of the conveyor.

6.4 Where impact with the CATS pipeline was suspected, the pipeline would be shutdown (closure of isolation valves offshore to prevent further gas entering the CATS pipeline) to allow detailed investigation to be undertaken. In addition, and prior to excavating to allow a detailed inspection, the pressure within the pipeline would be reduced by approximately half (to c. 60 barg). This reduction in pressure would act to reduce the stress on the pipe wall at any potential defect site, thereby lessening the risk of rupture.

6.5 The table below presents the anticipated shutdown durations for the various repair options identified.

Repair option	**Duration of CATS pipeline shutdown (weeks)**
Excavate to inspect pipeline, repair not required	7
Excavate to inspect pipeline and engineered wrap required	9
Excavate to inspect pipeline and engineered clamp required	13
Excavate to inspect pipeline and replacement of section required*	22

* Full depressurisation of pipeline required (from 60 barg)

6.6 The CATS pipeline supplies approximately 8% of the UK natural gas demand. Therefore, an impact on the CATS pipeline would have a significant impact on the 'security of supply' of natural gas to the UK.

6.7 As well as supplying the UK with natural gas, the operation of the CATS pipeline is critical for purposes of the production of oil from those fields which rely on a gas export route via the CATS pipeline. When oil is extracted natural gas is also produced. Previously this natural gas was flared (burned) at the point of oil production. However, as well as a loss of a valuable natural resource, this process produced emissions harmful to the environment. Controls are now imposed on the flaring of gas, meaning that the ability to export the gas is an essential element of oil production. When the CATS pipeline is shut down, the oil platforms it serves will most likely also need to curtail or shut down production.

6.8 In 2007, the CATS Pipeline was damaged by an oil tanker (the Young Lady) that had dragged its anchor. Although the damage to the CATS pipeline was relatively minor (requiring recoating and fitting of a protective sleeve) the pipeline was out of use for a period of 2 months. During this time oil and gas production was reduced and platforms that had been shutdown for maintenance were prevented from coming on stream.

6.9 The direct financial loss to the CATS Parties as a result of a 7 to 22 week shutdown is estimated to be of the order of £25 million to £80 million. This does not include the value of product lost in reducing the pressure of the CATS pipeline or the costs associated with inspection and repair of the CATS pipeline. This is in addition to the impact on users of the CATS pipeline / upon those parties who have contracted to export gas production via the CATS pipeline and the implications for UK natural gas supply and oil production.

6.10 Attached with this submission is the Report of the Government "Maritime Accident Investigation Branch" into the incident involving the Young Lady oil tanker. Whilst much of this report deals with the maritime elements of the incident, it provides further information on the strategic importance of the CATS pipeline, and the implications of an impact affecting its operation.

6.11 The operational impacts to the UK natural gas and oil industries as well as the associated economic impacts not only to the CATS Parties but also its customers are significant material considerations in the context of the choice of conveyor alignment.

6.12 The QRA of the impact of the proposed development on the CATS pipeline confirms that the frequency with which the CATS pipeline could be impacted was an order of magnitude higher for the southern alignment than the northern alignment[1].

7 QUANTITATIVE RISK ASSESSMENT

7.1 A meeting was held between the CATS Operator, YPL and its contractor, Royal Haskoning DHV on 4th December 2015 to review the summary of the Quantitative Risk Assessment (QRA) for the potential routing options of the overland conveyor, submitted to the Planning Inspector on 24th November. Details of the matters agreed and not agreed are set out in Section 3 above.

7.2 The impact of the areas not agreed on the results of the QRA are detailed below

CONVEYOR ROUTE	**SOUTHERN**		**NORTHERN**		**NORTHERN CORRECTED**	
	Events / yr		**Events / yr**		**Events / yr**	
	CATS	YPL	CATS	YPL	CATS	YPL
Multiple on	8.23E-04‡	1.35E-05‡	5.38E-06*	2.03E-08*	2.09E-05*	5.93E-08*

[1] 2.2E-01 per year as opposed to 1.7E-02 per year – CATS Operators' submission to the Planning Inspectorate 24 November 2015

and off site fatalities‡						
Multiple fatalities on site (< 50)	2.52E-03	3.98E-06	7.44E-05	1.92E-07	2.12E-04	5.67E-07

‡ Worst-case risk of greater than 100 fatalities within the relevant populations

* Worst-case risk of less than 50 fatalities within relevant populations

7.3 This section of the submission presents further information in support of the CATS Parties' position that the findings of the QRA are valid, and that the southern alignment presents an intolerable level of risk.

The Level Of Risk Mitigation That Can Be Claimed For Administrative Controls (In The Form Of The Protective Provisions)

7.4 The assumption made in the QRA was that a single error could result in the CATS pipeline being impacted during one of the main construction activities (e.g., piling, excavation, heavy lift etc.). The probability of such an error was taken to be 1-in-1000 (0.001) per opportunity. As agreed with YPL, this figure relates to routine operations and/or well-trained operators/operatives with no stress and independent verification.

7.5 In considering the probability of an error, the PPs were assumed to be in place. Significant effort has been expended by the CATS Parties and the applicant in defining the technical details of the PPs and a brief summary is detailed below:

7.5.1 Initial location of pipeline to be ascertained by referring to the asset owner's drawings and to be verified by other means;

7.5.2 Requirement to expose the crown of the pipeline by hand digging;

7.5.3 Requirement to confirm the location of the pipeline in the presence of the asset owner;

7.5.4 Requirement for excavating at the location to ensure no potentially vulnerable assets are present;

7.5.5 If necessary: physical separation between the asset and pile/excavations (to be agreed with the asset owner); and

7.5.6 Requirement to pre-plan the location, timing and duration of works to give the asset owner (CATS Parties) enough time to comment.

7.6 It is the CATS Parties' position that the PPs form a single layer of protection for the CATS pipeline against the construction activities of the proposed development. This layer is the identification of the location of pipeline.

7.7 There are a number of discrete steps included within the PPs, all of which are designed to identify the location of the pipeline and thus mitigate the risk of pipeline being impacted. On this basis, the protections afforded to the CATS pipeline by the PPs are appropriate and mitigate the risk to the extent that can be reasonably expected for Administrative Controls. However, as with any Administrative Control, they take the form of procedures and as such are reliant upon human enforcement. Furthermore, the PPs are wholly dependent upon the correct initial identification of the location of the CATS pipeline. Should an error be made in the first and most significant step, the multiple subsequent layers become irrelevant.

7.8 Moreover, the topography and congested nature of the southern alignment in particular should be considered. The area in which the conveyor will be constructed and over-sail the CATS pipeline is bounded by above ground pipelines. This will necessitate the construction machinery (piling rig, crane etc.) to be located above the pipeline in order to gain access to complete works necessary erect the conveyor. Therefore, the effectiveness of any pre-works to identify and mark the location of the pipeline or provide physical separation between the pipeline and construction activities in protecting pipeline should be accounted for and are more likely to be negated. In addition, due to the congested nature of the southern alignment, any error made is more likely to lead to the CATS pipeline being impacted due to the activities being in close proximity to the pipeline. On this basis, the CATS Parties consider the assumption that a single error can result in an unsafe condition to be valid.

7.9 Due to the magnitude of the consequences of making an error and the CATS pipeline being impacted during the construction phase of the development, representatives from a number of different organisations will take a role in implementing the PPs. This will include the applicant and their principal contractor, CATS Operator and CATS Parties, and a third party inspection body. A simple, but incorrect assumption is that an error is required by several parties and in multiple steps for the unsafe condition to occur and the CATS pipeline to be impacted. The result of such an erroneous assumption would be that the error probability was 1-in-1000 for the first error and a further 1-in-1000 for the second error, thus providing an overall error probability of 1-in-1000000 (1-in-1 million or 1E-6 per opportunity). However, this dramatically overstates the risk mitigation that can be realistically claimed for Administrative Controls.

7.10 To put such a claim into context, the maximum risk mitigation that is commonly claimed for a Safety Instrumented Function (SIF - commonly referred to as a 'trip system') that automatically takes action to prevent an unsafe condition in the Nuclear industry is between 0.001 (1-in-1000 or 1E-3) and 0.0001 (1E-4) per opportunity. The scale used to describe the risk mitigation provided by a SIF is Safety Integrity Level (SIL) and is described in *IEC 61508:2010 Functional safety of electrical / electronic / programmable electronic safety-related systems* and ranges from SIL1 (0.1 (1E-1) to 0.01 (1E-2) per opportunity) to SIL 4 (0.0001 (1E-4) to 0.00001 (1E-5) per opportunity). The example of the Nuclear industry equates to SIL3. The assumption that two errors are required for a failure in the PPs to protect the CATS pipeline results in a risk mitigation of 1E-6 per opportunity. This approach suggests that Administrative Controls can provide two orders of magnitude greater risk reduction than that typically used for an automated SIF in the Nuclear industry and an order of magnitude greater than can be claimed for any automated SIF. On this basis, the assumption that two

errors are required clearly overstates the risk mitigation that can be claimed for the PPs and contravenes accepted practice within the process industries (Chemical, Oil & Gas, and Nuclear).

7.11 The effectiveness of Administrative (or procedural) Controls was considered following the Buncefield incident in '*Safety and Environmental Standards for Fuel Storage Sites' Process Safety Leadership Group Final Report)*[2], where the following comment was made 'Note that management system and standard operating procedures cannot be claimed as a protection layer in their own right … Instead, procedures are incorporated in the performance claimed for a protection layer because they define requirements for the conduct of activities and therefore are included implicitly rather than explicitly within the analysis' (Annex 6 para 193, page 117). On this basis, to claim a second layer of protection as a result of the multiple Administrative Controls included in the PPs is incorrect.

7.12 Considering the effect on the error probability rate of the verifiers from other organisations on error probability, *HSE Offshore Technology Report 2001/053 Preventing the propagation of error and misplaced reliance on faulty systems: A guide to human error dependency*[3] states 'credit can only be taken of one independent checker. No credit is usually given for a second independent check' (page 59). Therefore, as the agreed error probability rate of 0.001 per opportunity includes independent verification, no further risk reduction can be claimed for multiple checkers from other organisations.

7.13 Furthermore, due to the prolonged duration of the construction phase of the proposed development, it is the consideration of the CATS Parties that irrespective of the different organisations represented, a team will form. This presents the possibility of incorrect decisions being taken by the group and the phenomenon of 'groupthink' acting to negate the risk mitigation presented by independent verification of the PPs. Groupthink is a widely accepted social psychological occurrence whereby 'A group of people arrives at a consensus without adequately evaluating all alternatives, perhaps with individuals' self-censoring doubt and thereby giving an illusion of unanimity' (HSE Offshore Technology Report 2001/053[4], page 16). There are notable examples of incidents where there was one team working together from different organisations. In these examples, respected commentators have cited pressure brought to bear on individuals from different organisations resulting in them deferring to the expert contractors, and an incorrect group decision being made. Again, this supports the CATS Parties view that a single error could result in the unsafe condition.

7.14 Finally, the dependency of the separate PPs should be considered. Notwithstanding the foregoing discussion, only if layers of protection are truly independent can full credit be taken for the mitigation provided. *Guidance on quantified human reliability analysis (QHRA) by the*

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[2] http://www.hse.gov.uk/comah/buncefield/fuel-storage-sites.pdf

[3] http://www.hse.gov.uk/research/otopdf/2001/oto01053.pdf

[4] As 3, HSE Offshore Technology Report 2001/053

Energy Institute, Nov 2012[5] states 'There are two aspects of dependence. One is concerned with the fact that checks being carried out by a second person are rarely truly independent. The other is that activities performed by the same operator or team may be subject to systematic biases which mean that certain failure modes may be repeated' (pg 23). As all parties will be working with the same information, drawings and visual clues the separate verification activities cannot be considered to be independent. HSE presents guidance in determining the dependency of layers of protection in *Preventing the propagation of error and misplaced reliance on faulty systems: A guide to human error dependency*[6]. This methodology was applied to the PPs and the result was that there is 'high dependence' between the differing steps within the PPs; the detail of the assessment can be found in Appendix 1. As such, an error probability of 0.5 could be claimed in addition to the original 0.001 per opportunity. However, the view of the CATS Parties is that on the basis of the preceding arguments relating to the congested nature of the southern alignment, potential for incorrect group decisions and the parallels drawn with the reliability of SIFs additional credit should not be taken for the PPs over and above the original 1-in-1000 per opportunity.

7.15 In conclusion, the CATS Parties consider that the PPs present a single layer of protection in determining the location of the CATS pipeline and as such, a single error can lead to an unsafe condition. Moreover, the view that two separate errors are required and a risk mitigation of 1-in-1 million can be claimed for the PPs has been shown to be erroneous due to the congested nature of the southern alignment, the likely dependence of verification from separate organisations and inference that Administrative Controls can provide a greater risk mitigation than the most reliable SIF as defined by IEC 61508:2010.

The Impact of over Familiarisation and Normalisation of Risk on Human Error Rate for Repetitive Activities

7.16 By virtue of the distance that the southern alignment over sails the CATS pipeline, the frequency of key construction activities that can impact the CATS pipeline are significantly higher than for the northern alignment.

7.17 In the QRA, the CATS Parties considered that the increased frequency and repetitious nature of the tasks would lead to over familiarisation with the task, a desensitisation or normalisation of the risk and thus a greater propensity for error on the southern alignment than the northern alignment. As a result, a factor of ten increase was applied the base error rate of 1-in-1000 per opportunity for the southern alignment, resulting in an error rate of 1-in-100 per opportunity.

7.18 A counter position could be constructed, whereby the effect of over familiarisation with the task was offset by the fact that knowledge and familiarisation simplified the task. The result of such a hypothesis would be that the base error rate would remain unchanged (at 1-in1000 per opportunity). However, the CATS Parties considered and rejected such a premise on the basis that the increased error rate was not a factor of competency or lack thereof, but

[5] http://publishing.energyinst.org/__data/assets/file/0019/51841/QHRA-Guidance.pdf
[6] As 3, HSE Offshore Technology Report 2001/053

normalisation of risk leading to the potential of reduced effectiveness of the PPs and deterioration in adherence to procedure.

7.19 The subject of Human Reliability Assessment (HRA) provides a means to assess the human contribution to risk. There are a number of HRA methodologies and tools available within literature that provide a quantitative assessment of the impact of environmental conditions on a generic human error rate for a task. The CATS Parties identified and implemented one such method, Human Error Assessment and Reduction Technique (HEART) to quantify the difference between the human error for the southern and northern alignments. HSE Research Report *Review of human reliability assessment methods by the HSL (2009) RR67*[7] states that 'HEART is one of the HRA methods that has been empirically validated' and 'HEART is widely used in the UK nuclear industry, and also in most other industries (chemical, aviation, rail, medical).' (Validation - page 15).

7.20 The general premise of HEART is:

7.20.1 Basic human reliability is dependent upon the generic nature of the task to be performed.

7.20.2 In 'perfect' conditions, this level of reliability will tend to be achieved consistently with a given nominal likelihood within probabilistic limits.

7.20.3 Given that these perfect conditions do not exist in all circumstances, the human reliability predicted may degrade as a function of the extent to which identified Error Producing Conditions (EPCs) might apply.

7.20.4 There are 9 Generic Task Types (GTTs) described in HEART, each with an associated nominal human error potential (HEP), and 38 Error Producing Conditions (EPCs) that may affect task reliability, each with a maximum amount by which the nominal HEP can be multiplied.

7.21 In considering the differences between the southern and northern alignments, the CATS Parties identified three EPCs that could increase the HEP for the southern alignment; namely:

7.21.1 *A mismatch between perceived and actual risk* – multiple occurrences of completing the task without consequence may lead to normalisation of risk;

7.21.2 *The need to transfer specific knowledge from task to task without loss* - the southern alignment requires specific knowledge about adjacent pipelines and services and therefore restrictions on piling locations; and

[7] http://www.hse.gov.uk/research/rrpdf/rr679.pdf

7.21.3 *Poor, ambiguous or ill-matched system feedback* – there will be no feedback as to how close the previous piling activities have come to impacting the CATS pipeline. Therefore, those undertaking the task will be unaware of a potential error and thus danger.

7.22 The result of the HEART assessment was that the potential for error on the southern alignment was approximately 9 times higher than that of the northern alignment. The detail of the assessment is presented in Appendix 2. Therefore, the factor of ten increase in the base human error rate applied by the CATS Parties in the QRA was justified.

Base Input Information with Respect to the Risk Presented by Vehicle Movements in the Pipeline Corridor

7.23 In conducting a risk assessment, frequencies of initiating events are required. Probabilities of subsequent events are then applied to the initiating events to determine the frequency of a stated outcome. The initial data for such an assessment is typically generic in nature and is published in appropriate reference material and is widely accepted. This generic data is then tested against knowledge and experience specifically relating to the event that is being assessed. If specific information is available, this is used to substitute or modify the generic data, such that the outcome of the assessment is more accurate.

7.24 In considering the risk presented by vehicle movements in the pipeline corridor (specifically relating to the southern alignment), the CATS Parties cited historic data rather than generic data for the reasons detailed above. There has been an incident in a third-party managed pipeline corridor where a CATS owned and operated above ground pipeline was impacted by a vehicle and remediation to the pipeline was required. Work Control measures were in place along with the procedural controls referred to by the applicant in the Constructability Notes. As such, the CATS Parties considered the risk presented by vehicle movements to above ground pipelines to be credible.

7.25 The CATS pipelines have been in place for approximately seventeen years and one incident has been recorded. In determining the frequency for the QRA, the historic frequency data was halved, resulting in a frequency of vehicle impact of 1-in-30 years. This was considered to be valid and to not overstate the risk. The stated outcome was a 'domino effect' of an incident on a third-party pipeline in the pipeline corridor (southern alignment) impacting the CATS pipeline. The subsequent probabilities leading to a failure of the CATS pipeline reduced this frequency down to 1.24E-5 per year (ca. 1-in-80000 years) for multiple on and offsite fatalities. As such, this was not the dominant cause for a hazardous event that could have offsite implications. However, the use of specific, rather than generic frequency data was considered to follow accepted industry practice and also present a more accurate result as generic data may well understate the risk.

8 INDEMNITY

8.1 The applicants have proposed an indemnity within Schedule 9 (paragraph 28(2)) to cover certain loses incurred by affected parties, including the CATS Parties.

8.2 The wording proposed contains a number of qualifications on the application of the indemnity. In particular, the indemnity extends only to losses "reasonably incurred" and would not extend to any losses incurred as the result of negligence on the part of the affected party (eg the CATS Parties).

8.3 Whilst such exclusions may be appropriate in a commercial arrangement in this case the CATS Parties will obtain no benefit from the Proposed Development. As such, it is submitted that a "no fault indemnity" should apply and that the CATS Parties should not be required to address challenges of negligence that may be relied upon to avoid or reduce liability under the indemnity.

8.4 Attached at annex 3 is proposed wording for the indemnity to be included in Schedule 9. This indemnity follows the same approach as is widely used in the oil and gas industry for pipeline crossing agreements and agreements in respect of works proximate to pipelines. It recognises that the indemnified party (eg CATS Parties) accrues no benefit from the development and therefore should not be required to carry any of the risk. It includes a cap on liability of the party performing the relevant work. The CATS Parties have concerns as to the ability of the applicants to secure appropriate insurance cover – as is also required under the PPs, which is essential to the acceptability of indemnity.

8.5 An indemnity on materially the same terms as attached is regularly used by those in the oil and gas industry, and was entered into, for example, by the Scottish Government in respect of the Queensferry Crossing (new Forth Road Bridge).

8.6 The need for an effective indemnity underpins the PPs, which themselves are essential to the acceptability of the Proposed Development. If the indemnity is not adequate, it calls into question the value of the protections offered in Schedule 9.

8.7 Although the applicants have indicated they are not agreeable to the principle of a separate indemnity for the CATS Parties, it is understood that the attached wording is generally agreed. As such, if the Inspector was minded to recommend the approach proposed by the CATS Parties, the indemnity wording is agreed and would not delay finalising the DCO.

9 CONCLUSION

9.1 The CATS Parties have undertaken detailed discussions with the applicant regarding the mitigation of risk posed by the Proposed Development.

9.2 A series of PPs have been agreed, and provided these are properly implemented (and appropriate indemnity provision put in place), the CATS Parties are satisfied that the northern alignment would be acceptable. As previously indicated, the CATS Parties would expect the applicant to take all reasonable steps within the northern alignment corridor to minimise the interaction between the Proposed Development and the CATS Pipeline.

9.3 It is not disputed that the southern alignment represents a higher risk than the northern alignment. The applicant's statements about the benefits of the southern alignment are

general and not quantified. They relate only to the benefits to the Proposed Development and do not take into account the impacts on other users, including the CATS pipeline.

9.4 Given that the benefits of the Proposed Development will be delivered by the northern alignment, and the increased safety, operational and economic risks posed by the southern alignment, it is respectfully submitted that the southern alignment should not be permitted.

APPENDIX 1: DEPENDENCY OF LAYER OF PROTECTION

1 HSE publication *Preventing the propagation of error and misplaced reliance on faulty systems: A guide to human error dependency*[8] presents a methodology for determining the dependency of layers of protection.

2 The separate steps in the PPs essentially mitigate the risk of making a single error in determining the location of the CATS pipeline. The methodology for determining dependency was as follows:

2.1 Identify the error – location of CATS pipeline in this instance

2.2 Consider the checklist of Contributory Factors (CF) presented in Table 2 (page 34[9]) that may lead to separate layers of protection having dependency on one another

2.3 Make a judgement on the level of dependency (Table 1 – page 31[9]) for each CF in the separate layers of protection

2.4 Sum the Level of Dependence for the CFs

2.5 The predominant level of dependency is applicable for the assessment

Table 1: Judgement scale for level of dependency

Level of Dependence	Description
Complete	The actions of one person are entirely dependent on the actions / errors of another person or operation of equipment or their own previous actions, i.e. the error will ALWAYS be repeated by the same or another person.
High	On most but not all occasions the individual(s) behaviour will be influenced by the operation of systems or other people.
Moderate	Individuals' actions will often be influenced by the operation of systems or other people.
Low	Individuals' actions will rarely be influenced by the operation of systems or other people.

[8] As 3, HSE Offshore Technology Report 2001/053

Level of Dependence	Description
Not at all	No reason at all can be identified for one person's actions to be influenced by the operation of systems or other people

2.6 This method was followed and the completed Table 2 is presented below

Table 2: Assessing the level of dependence (optional aid)

Contributory Factors	Not at all	Low	Moderate	High	Complete
Individual factors					
1) Individuals are unfamiliar with the task such that it will not be obvious to them that they've gone wrong?		X			
2) Staff involved in double-checking tasks etc are NOT aware of the importance of such checks in achieving the required standards of safety and reliability?			X		
3) To what extent do staff perceive the task of double-checking / signing-off (say) permits to work a monotonous duty?			X		
4) Is reliance placed on staff to check their own work, without an independent check or occasional spot check by colleagues / superiors?	X				
5) Do staff complete the same or similar tasks in quick succession?				X	
6) In cases where individuals work on a series of items of equipment, how similar is the design of such equipment?					X
7) In cases where individuals work on a series of items of equipment, does the design of controls /valves etc permit the same action to be repeated across equipment?	NA				
8) Could staff wrongly assume that different equipment are operated in the same way?	NA				
9) Could staff mistakenly transfer training / practices from one task to another?				X	

Contributory Factors	Not at all	Low	Moderate	High	Complete
10) Could staff develop "bad habits", repeating short cuts across tasks without any apparent risk?					X
11) Do staff demonstrate a low level of diligence or commitment to complying with procedures etc?	NA				
12) To what extent might self-confidence lead staff to become over-confident, causing them to overlook their errors or consider possibility of error?					X
13) Are there reasons to suppose staff will over-simplify a problem, perhaps because it is complicated and they are time pressured, thereby making a series of mistakes?				X	
14) Are there reasons to suppose staff will become fixated or focused on one particular view of a problem without considering alternatives?				X	
15) Would the stress of the situation lead people to want to "get on with" the task?				X	
16) Does the task difficulty (workload, awkward equipment and procedures, environmental conditions, time pressure etc) deter people from re- doing a task or checking whether they have done it correctly – even when they suspect they may have done it wrongly?			X		
System factors					
17) How likely is it that people will become reliant on automatic systems and presume reliability, such that they fail to monitor the situation or check for system failures?	NA				
18) Staff are unaware of the failure modes of automatic systems and how these may be detected / recognised?	NA				
19) To what extent will staff assume that equipment, processes etc are sufficiently reliable to render double-checking of equipment unnecessary, such as checking plant at the start and part way through a shift?				X	

Contributory Factors	Not at all	Low	Moderate	High	Complete
20) How likely is it that personnel skills and standards of vigilance will be eroded by the introduction of new technology or task duplication, such that they cannot be relied on to perform to the same standards in the absence of such technology?	NA				
21) How likely is it that the use of automatic control and warning systems will mean that people will fail to monitor operations such that when they do need to intervene they do not have an appreciation of the situation?	NA				
22) Does the design of control and instrumentation, complexity of procedures etc dissuade people from double-checking the actions, decisions and judgements of colleagues?	NA				
Inter-Individual factors					
23) How likely are staff to accept the opinion of colleagues without question, perhaps due to a deferential attitude, a presumption of competence or a wish for peer approval / consensus?				X	
24) How likely are staff to "go along" with the mainstream opinion rather than challenge opinions, check information etc?				X	
25) Does the wish to maintain group cohesion inhibit people from "rocking the boat", expressing doubts, offering contrary information etc?			X		
26) How likely are peers, supervisors, senior officers etc to presume that the level of competence of other staff is enough to mean they do not need to check for errors or omissions?			X		
27) How likely are team leaders to solicit and seek out alternative opinions in a way that avoids self-censorship and false consensus?				X	
28) Are staff aware that they may suffer from "tunnel vision" and "group think" in stressful situations and that they need to retain a degree of individual perspective, situation awareness and actively consider alternative views of what is happening?				X	

Contributory Factors	Not at all	Low	Moderate	High	Complete
29) To what extent may staff assume that they do not need to double-check (as stipulated in procedures) whether (say) the correct part has been issued by stores as someone else will have done so already or will do so before the part is used?			X		
30) Do staff assume that colleagues will, at shift hand- over for example, inform them of anything important, rather than actively request information / status information?				X	
Error detection and recovery					
31) Is time between an error and its consequence so short that people do <u>not</u> have time to reflect on their actions and decisions, thereby detecting their own and others errors?					X
32) Is the indication of the status of plant, equipment, and processes etc ambiguous or poorly presented?					X
33) Does the task difficulty (workload, awkward equipment and procedures, time pressure) deter people from checking one another?			X		
34) Do staff mistrust instrumentation?	NA				
Total	1	2	6	11	5

3 As can be seen from Table 2, the predominant level of dependency was 'High Dependency'. Thus, the separate steps identified in the PPs to mitigate the risk of an error in identifying the location of the CATS pipeline can be considered to have 'high dependency' on one another.

4 The publication[9] then provides an example numerical value for the additional level of mitigation that can be claimed for layers of protection with high dependency. This value is 0.5 (page 58[9]). Therefore, the probability that additional layers of protection with high dependency will prevent the error is 50:50.

APPENDIX 2 – HEART

1 Human Error Assessment and Reduction Technique (HEART) is a human reliability assessment that enables the quantification of the potential for human error.

2 The principle of HEART is that a base human error potential (HEP) for completing a task incorrectly is defined. In 'perfect' conditions, this level of reliability will tend to be achieved consistently. However, the propensity of a human to make an error may increase as a result of external factors that may apply (Error Producing Conditions – EPCs). 38 EPCs are defined within the technique that may affect the task and thus increase the HEP.

3 The HEP considered in the analysis was the base human error probability of 0.001 per opportunity.

4 HEART was used by the CATS Parties to investigate the potential for an increased HEP between the southern alignment and northern alignment due to the increased frequency and repetitive nature of major construction activities for the southern alignment.

5 In considering the differences between the southern and northern alignments, the CATS Parties identified three EPCs that could increase the HEP for the southern alignment; namely:

5.1 *EPC #12 A mismatch between perceived and actual risk* – multiple occurrences of completing the task without consequence may lead to normalisation of risk

5.2 *EPC #10 The need to transfer specific knowledge from task to task without loss* - the southern alignment requires specific knowledge about adjacent pipelines and services and therefore restrictions on piling locations

5.3 *EPC #13 Poor, ambiguous or ill-matched system feedback* – there will be no feedback as to how close the previous piling activities have come to impacting the CATS pipeline. Therefore, those undertaking the task will be unaware of a potential error and thus danger.

6 The maximum impact of the identified EPCs (the number by which the HEP is multiplied) is given in the technique to be a factor of 4 for EPC #12, 5.5 for EPC #10 and 4 for EPC#13.

7 The next step within HEART is to determine the assessed proportion of effect (ASOP). The ASOP is an assessment of the conditions and circumstances that may lead to the EPC being applicable to the task under consideration. This is essentially a measure of the relevance of the EPC to the task, with fully relevant resulting in ASOP of 1 and no relevance a value of 0 (zero).

8 The CATS Parties' position is that EPC #12 is fully relevant to potential of human error as a result of over familiarisation and normalisation of risk, thus an ASOP of 1 was applied. Whereas, EPC #10 and #13 less so, and thus ASOP of 0.1 were applied to both.

9 The calculation methodology to determine the predict the actual HEP (taking into account the EPCs) is:

9.1 HEP (actual) = HEP (generic) x $((EPC_1 - 1) \times ASOP_1) + 1) \times ((EPC_2 - 1) \times ASOP_2) + 1) \times \ldots$

9.2 The calculation for over familiarisation and normalisation of risk for the southern alignment is detailed below

Generic HEP	EPC	ASOP	Assessed effect (EPC – 1) x ASOP + 1	Actual HEP
0.001	5.5	1	5.5	0.0093
	4	0.1	1.3	
	4	0.1	1.3	

10 Thus, via application of HEART, the potential for error on the southern alignment was demonstrated to be approximately 9 times higher than that of the northern alignment

11 The QRA stated a factor of 10 increase, which has been validated by the use of the HEART technique.

APPENDIX 3 – INDEMNITY FOR INCLUSION IN SCHEDULE 9

(3) The undertaker indemnifies and keeps the operator and owners of the cats pipeline indemnified against all reasonable costs, charges, damages and expenses, and against consequential loss and damage, which may be occasioned or reasonably incurred by the owners and operator—

(a) by reason of the construction, operation, maintenance, repair and decommissioning of the authorised development or the failure thereof; or

(b) by reason of any act or omission of the undertaker or of any person in its employ or of its contractors or others whilst engaged upon the construction, operation, maintenance, repair and decommissioning of the authorised development,

and the fact that any act or thing may have been done by the operator or owners of the cats pipeline on behalf of the undertaker or in accordance with plans approved by or on behalf of the owner or operator or in accordance with any requirement of the engineer appointed by the owner or operator or under his supervision will not (if it was done without wilful misconduct on the part of the owner or operator or of any person in their employ or of its contactors or agents) excuse the undertaker from any liability under the provisions of this sub-paragraph 28(3).

(4) The total aggregate liability of the undertaker to the operator and owners of the cats pipeline in respect of the matters referred to in sub-paragraph 28(3) shall be limited to the sum of one hundred million pounds for any one event or series of connected events save where the matters referred to in sub-paragraph 28(3) arise as a result of the undertaker's wilful misconduct.