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**Subject:** 151123 TR030002 Explanatory note for Risk Assessment of the interaction of York Potash & CATS pipeline  
**Date:** 23 November 2015 14:30:37  
**Attachments:** [Explanatory note for Risk Assessment of interaction of YPM and CATS pipe....docx](#)

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Dear Sir / Madam,

In relation to the York Potash harbour facilities DCO, the CATS Operator previously confirmed to York Potash that we would be undertaking a risk assessment of the interaction between the York Potash & CATS Pipeline. We shared the detailed output of this analysis with York Potash on 2<sup>nd</sup> November 2015.

Ahead of the issue specific hearing that will take place tomorrow in Redcar, we have prepared the attached explanatory note which summarises our current position on this development after undertaking this risk assessment.

I have also CC'd James Barrie to ensure that the applicant has also seen this explanatory note ahead of tomorrow's hearing.

Please confirm receipt of this email.

Regards

**Andy McDonald**

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## **EXPLANATORY NOTE – RISK ASSESSMENT OF THE IMPACT OF THE YPM OVERLAND CONVEYOR NORTHERN & SOUTHERN ROUTES ON THE CATS PIPELINE.**

### **SUMMARY**

The CATS operator, on behalf of the CATS Parties, has undertaken a risk assessment of the interaction of the proposed YPM development (both Northern and Southern Routes for the YPM Overland Conveyor) with the CATS pipeline, in accordance with the regulatory system and guidance applicable to our industry. This risk assessment took the form of an independently led Hazard Identification (HAZID) study and subsequent Quantitative Risk Assessment (QRA).

On the basis of the results of the QRA, the fundamental principle of risk avoidance as set out in *The Management of Health and Safety at Work Regulations 1999*, and guidance on the *tolerability* of risk from HSE document '*REDUCING RISKS, PROTECTING PEOPLE: HSE's decision-making process*', 2001 (*Known as R2P2*), the CATS operator on behalf of the CATS Parties maintain their objection to the Southern Route.

The proposed development does not need both the Southern and Northern Routes to operate. It is an either/or choice. The applicant has expressed an operational preference for the Southern Route, but they continue to promote the Northern Route, and it is clearly acceptable to them.

The Northern Route alternative mitigates risk, and is consistent with the principle of risk avoidance. It is a route that is acceptable to the applicant. In light of this, and the significant risks associated with the Southern Route, the CATS Parties request that the proposed development proceeds on the basis of the Northern Route only.

### **INTRODUCTION**

The CATS operator, on behalf of the CATS Parties, has previously made written representations objecting to the YPM Overland Conveyor Southern Route. The objections have identified significant safety concerns and increased societal risk<sup>1</sup> presented by the interaction of the Southern Route with the CATS high pressure gas pipeline.

The CATS Parties' concern is that the integrity of the CATS pipeline could be compromised during the construction or operational lifecycle of the proposed YPM development. The CATS pipeline conveys natural gas at 120 barg (approximately 60 times higher than the domestic gas distribution network) and a release of gas with subsequent ignition would present significant societal risk to not only the applicant and their contractors, but also neighbouring populations.

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<sup>1</sup> Societal risk is a single measure of the chance of accidents that could harm a number of people in one go

The CATS Parties' position is founded upon the fundamental 'principle of prevention' as detailed in Clause 4 of *The Management of Health and Safety at Work Regulations 1999*<sup>(1)</sup>, and more specifically 'avoiding risks' from Schedule 1 (a) General Principles of Prevention from the same document.

In the process industries, this principle has been further expanded and adopted as "Inherent Safety". HSE Publication *OTH 96 521 Improving Inherent Safety*<sup>(2)</sup> states, 'An inherently safer approach to hazard management is one that tries to avoid or eliminate hazards or reduce their magnitude, severity or likelihood of occurrence, by careful attention to the fundamental design and layout. Less reliance is placed on 'add-on' engineered safety systems and features, and procedural controls which can and do fail' (OTH 96 521, pg. i).

The CATS Parties do not oppose the principle of the potash mine development, and recognise that as part of the development a route is required to take the minerals to harbour for export. They have not advocated a "no development"/"do nothing" approach, but sought to work with the applicant to identify a solution that may be acceptable.

When considering the routes for the Overland Conveyor proposed by the applicant within the Development Consent Order (DCO), the fundamental principles of inherent safety dictate that the Northern Route is clearly preferential compared to the Southern Route.

The Southern Route requires multiple and significant construction activities (hundreds), including piling and major lifting operations to be conducted within close proximity to a number of Major Accident Hazard Pipelines (including the CATS pipeline) as defined by the *Pipeline Safety Regulations 1996*<sup>(3)</sup>. The conveyor will in fact run above (over sail) the CATS pipeline for a distance of approximately 2000m. It should be noted that presently there is [no] oversailing of the CATS pipeline.

By contrast, the Northern Route, as recently confirmed by the applicant, will run above the CATS pipeline for a distance of 200 - 300m on the basis of the current plans, thus having a significantly lower potential for the hazards to be realised. This is considered to be a worst case scenario, as there is scope within the DCO for the conveyor to be moved slightly so as to reduce the oversail distance even further.

The applicant has suggested Protective Provisions ('PPs') to try and address risks. It should be noted that the applicant is proposing the same PPs for both Routes.

Whilst PPs can be agreed to mitigate the risk of the hazards materialising, these PPs will not eliminate the risk. Moreover, the proposed PPs largely take the form of Procedural Controls, which are the type of control measure at most risk of failure due to human error. The principle of avoidance or inherent safety provides the most robust and effective form of risk reduction associated with major accident hazards, as in this case. The PPs are a form of mitigation that should be applied as well as, and subject to, the fundamental principle of risk avoidance. The Protective Provisions are no substitute for the application of this principle.

## **RISK ASSESSMENT**

The nature of the proposed development and magnitude of the potential hazards presented to the CATS pipeline during the lifecycle of the overland conveyor, are markedly higher than any experienced in the previous 20 years of operation of the CATS pipeline. These developments have typically been pipeline works that have not required piling for foundations or oversailed the CATS pipeline.

The applicant is no doubt attracted to the Southern Route by the absence of over ground structures. The absence of such structures is a consequence of the fact development has not been undertaken over the CATS pipeline and other pipelines. To date, development in the Pipeline Corridor has been limited. Given the unique nature of the conveyor development, the typical processes of qualitative risk assessment and monitoring for reviewing developments within the Pipeline Corridor (Southern Route) were not considered appropriate.

The reason for this decision was the perceived Major Accident Hazard risk the conveyor development posed to the CATS pipeline. *HSE Guide 'Risk Assessment A brief guide to controlling risks in the workplace'*<sup>(3)</sup> provides a principle and framework for conducting risk assessments. Hazards are first identified, and then risk assessed to determine tolerability. The principle of *The Control of Major Accident Hazards Regulations (COMAH) 2015*<sup>(4)</sup> (regulations 5(1) and 5(2)) requires the operator to demonstrate that major accident hazard risks are reduced to the level of 'As Low As Reasonably Practicable' (ALARP). The depth of risk assessment must be proportionate to the hazards and risks, with QRA being the most rigorous methodology. The outcome of a QRA produces a full

numerical representation of the frequency, and extent of a specified level of exposure or harm, to specified people on and off-site, or the environment, from a specified activity.

Due to the magnitude of the potential hazards presented by the proposed YPM development to the CATS pipeline and ensuing societal risk, the CATS operator has conducted a QRA. This decision was in line with general principles for risk assessment as detailed in *HSE Information Sheet: Guidance on Risk Assessment for Offshore Installations*<sup>5</sup>. The potential hazards and risks to the CATS pipeline were identified via an independently led (ABB Ltd) HAZID study. The construction and operational phases of both the Northern and Southern Routes were considered by the HAZID. The severity of the hazards and effected populations were identified along with potential mitigating actions. The HAZID report was shared with the Applicant and was used as the basis for agreeing appropriate PPs to mitigate the identified hazards as per the instruction from the Examining Authority. The CATS Parties position remains that PPs can only help mitigate a hazard, and as such the principle of avoidance should be applied so far as possible.

### **Quantitative Risk Assessment**

Three routes for the overland conveyor were investigated within the QRA; the Southern Route (approx. 2000m over sail), the Northern Route (as originally shown on the application plans with a single crossing point) and the corrected Northern Route (that includes approx 200m over sail).

The major activities from the lifecycle of the proposed YPM development, that could compromise the integrity of the CATS pipeline, were taken from the HAZID and used to generate the QRA. The major activities defined by the HAZID were 1) Piling (and associated excavation) adjacent to the pipeline, 2) Lifting adjacent to the pipeline, 3) Excavation to uncover the pipeline, 4) Traffic crossing the pipeline and 5) Vehicle movements in close proximity to above ground third party pipelines. The frequency of the activities was developed from the design details provided by the applicant, for each of the conveyor routes, and error rate probabilities were identified from available literature and appropriate reference sources. An example of an error rate, would be an error determining the location or depth of the pipeline, leading to contact between the piling machine (auger) and the CATS (buried) pipeline.

In determining the potential to make an error the number of occasions to make the error must also be considered. It is recognised in the oil and gas industry, that an individual undertaking a one-off or

infrequent task is more likely to pay more attention and complete the task correctly. Whereas, complacency or over-familiarisation with routine tasks, even with verification, can lead to an increased error rate. Therefore, due to the increased activities required for the Southern Route close to the CATS pipeline, the error rate for the Southern Route will be higher than the Northern Route. Finally, when determining the error rate, the PPs as contained in the CATS Parties' draft schedule 9 of 6 November 2015 were assumed to be in place.

Once the probability of error was determined, the severity of the event was established. Three outcomes were identified; a) full-bore rupture of the pipeline, b) minor leak or c) no release; the probability of each event was determined from available literature (including European Gas Pipeline Incident Data Group – EGIG and UK Onshore Pipeline Operators Association – UKPOA). The analysis considered that once gas was released, a source of ignition had to be present and a population in the vicinity for the ultimate hazard to be realised.

Ignition probabilities were once again based upon available literature (including EGIG & UKOPA) and populations at risk were determined from hazard consequence modelling completed within proprietary software (BP Cirrus & BP MARC). Differing populations were identified for the Southern and Northern routes. The relevant populations impacted by the Southern Route were identified as; a) the applicant and their contractors, b) the Tesco Distribution Warehouse, c) the Car Distribution Centre, and d) the Bransands Sewerage Works. The relevant populations impacted by the Northern Route were identified as; a) the applicant and their contractors, and b) the Bransands Sewerage Works., c) the A1085 Trunk Road and the Middlesbrough to Redcar railway line. The hazard ranges associated with a full-bore rupture of the CATS pipeline, were overlaid on the Northern and Southern conveyor routes, to identify the level of risk for each of the impacted populations. The QRA indicates that the Southern Route presented a worst case risk of greater than 100 fatalities, whilst the Northern Route presented a worst case risk of 50 fatalities. The hazard ranges of an ignited minor leak would not extend beyond the proposed development (no offsite impacts) and thus would only impact the applicant and their contractors; presenting a worst case risk of 50 fatalities for both Northern and Southern Routes.

The results of the QRA are presented in the table below:

	<u>Southern Route Events / yr</u>	<u>Northern Route Events / yr</u>	<u>Northern Route Corrected Events / yr</u>
<b>Multiple on and off site fatalities</b>	8.23E-04	5.39E-06	2.09E-05
<b>Multiple fatalities on site</b>	2.52E-03	7.43E-05	2.12E-04
<b>Gas released but disperses safely</b>	8.63E-02	2.45E-03	7.05E-03
<b>Pipe impacted, but no release</b>	2.22E-01	1.68E-02	4.54E-02
<b>Worst case societal impact (fatalities)</b>	>100	<50	<50
<b>Dominant Cause of Full-bore Rupture</b>	Error in pipeline position when excavating or piling	Error in pipeline position when excavating or piling	Error in pipeline position when excavating or piling

As can be seen, the QRA suggests that for the Southern Route, the interaction of the proposed YPM development with the existing CATS pipeline had the potential to cause an event that resulted in over 100 fatalities, at an event frequency of once in 1200 years (8.23E-4/YR). By contrast, the Corrected Northern Route had a lower societal risk, with a worst case severity of 50 fatalities, at an event frequency of once in 48000 years (2.09E-5/yr).

HSE Guidance '*REDUCING RISKS, PROTECTING PEOPLE: HSE's decision-making process*', 2001<sup>(6)</sup> (known as R2P2) provides guidance on the *tolerability* of risks. The HSE Guidance in R2P2 states that an incident, particularly where there is some choice as to whether to accept the hazard or not, which has the potential to kill more than 50 people and can occur with frequency greater than 2E-04 per year (one in 5000 per annum) should be regarded as *intolerable*.

Referring to the result of the QRA, the Southern Route exceeds the 2E-4 per year threshold by a factor of four. Therefore, the risk presented by the interaction of the Southern Route with the existing CATS pipeline has been assessed as *intolerable*; using the HSE Guidance provided within R2P2. (Note: the QRA assumes that the proposed PPs are in place)

By contrast, the results of the QRA indicate that the Northern Route is significantly above the threshold of risk *tolerability*, defined in the HSE Guidance R2P2.

There is an increased societal risk associated with transitory users of the A1085 Trunk Road and the Middlesbrough to Redcar railway. This could increase the worst case societal impact to over 100

fatalities. Even at this level (and making no allowance for the transient nature of the users of the A1085 Trunk Road and railway) the level of risk of the Northern Route would be well above the 2E-4 threshold. However, due to the infrequent occupancy due to the periodic nature of public transport, the event frequency would fall to the order of one in 500,000 years.

## **CONCLUSION**

The CATS operator on behalf of the CATS Parties objects to the Southern Route and requests that proposed development proceeds on the basis of the Northern Route alone. Moreover, making reference to the principle of risk reduction and tolerability within the COMAH Regulations, consideration should be given by the applicant to reducing the interaction of the Northern Route with the CATS pipeline to demonstrate the principle of ALARP; reducing the over sail of the conveyor route across the CATS pipeline to a minimum, and ideally to a single pipeline crossing location.

## **REFERENCES**

Ref 1 – The Management of Health and Safety at Work Regulations, 1999

<http://www.legislation.gov.uk/uksi/1999/3242/contents/made>

Ref 2 – HSE Publication 'Improving Inherent Safety' (OTH 96 521)

<http://www.hse.gov.uk/research/othpdf/500-599/oth521.pdf>

Ref 3 - HSE Guide 'Risk Assessment - A brief guide to controlling risks in the workplace (INDG163, rev4 2014)

<http://www.hse.gov.uk/pubns/indg163.pdf>

Ref 4 – The Control of Major Accident Hazards Regulations, 2015

<http://www.hse.gov.uk/pubns/priced/l111.pdf> (NB this is the HSE's guidance on the regulations)

Ref 5 – HSE information sheet: Guidance on Risk Assessment for Offshore Installations (3/2006)

<http://www.hse.gov.uk/offshore/sheet32006.pdf>

Ref 6 – Reducing Risks, Protecting People: HSE's decision making process, 2001

<http://www.hse.gov.uk/risk/theory/r2p2.pdf>