THE YORK POTASH HARBOUR FACILITIES ORDER 201X

Applicant's Response to BP CATS objection to the Southern Conveyor Route

Document 8.11

York Potash Limited

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YORKPOTASH
A Sirius Minerals Project

THE YORK POTASH HARBOUR FACILITIES ORDER 201X

APPLICANT'S RESPONSE TO BP CATS OBJECTION TO SOUTHERN CONVEYOR ROUTE

1. Discussions between the Applicant and BP CATS have resulted in full agreement on the appropriate protective provisions in Schedule 9 with the exception only of the issue of an appropriate form of indemnity (see Appendix 2 of Document 8.10).

2. Nevertheless, BP CATS are maintaining an objection to the southern conveyor route on the basis that, in its view, there are increased safety concerns relating to the southern route as evidenced, they say, by a Quantitative Risk Assessment (QRA). The position of BP CATS is set out in their Explanatory Note submitted for Deadline 5.

3. The Applicant commissioned its own advice in relation to the QRA undertaken on behalf of BP CATS. As a result, the Applicant does not accept the analysis referred to in that Explanatory Note. It believes that it is flawed, being based on the use of inappropriate, and subjective, assumptions.

4. The Applicant and BP CATS have discussed their different positions and have agreed a list of the disputed points. These disputed points, and the Applicant's position in relation to risk, are set out in the report from Royal HaskoningDHV commissioned by the Applicant contained in **Appendix 1** to this note.

5. The list of disputed points (in bold) along with a summary of the Applicant's position is set out below.

    1) **Risk reduction through Protective Provisions:** The Applicant will reduce the risks associated with the southern route through application of engineering controls in the form of agreed protective provisions. Based on the principles of Hierarchy of Control, this is an accepted method of risk reduction when risk elimination is not an appropriate method

    2) **Preference for the Southern route:** Although the southern route has an increased risk when compared to the northern route, it is still below the HSE guidance threshold. The increased risk of the southern Route is outweighed by the significant operational benefits associated with it.

    3) **Supervision of the protective provisions:** There will be multiple layers of supervision (including BP CATS, the Applicant's supervisor, the Applicant's contractor and Sembcorp). Failure to properly implement the protective provisions is unlikely as it would require two or more errors of supervision within different organisations. The revised QRA by Royal HaskoningDHV indicates the risk associated with the southern route is "tolerable" and the northern route is "acceptable" in accordance with HSE guidance.

    4) **The impact of over familiarisation and normalisation of risk on human error rate for repetitive activities.** The Applicant does not consider that the piling work is repetitive because it is not a "routine" task in the generally accepted meaning of the term. The piling activities are scheduled over a period over multiple months and executed by specialist contractors applying particular measures to minimise complacency. The additional risk for complacency would be offset by improved familiarity with the task. BP CATS use of an increased multiplication factor of 10 for this concern is not justified and distorts the results of their QRA making the overall risk 'Intolerable' in accordance with HSE guidance.

    5) **Base input information for vehicle movements in the pipeline corridor.** The frequency proposed by BP CATS is based on a single historical occurrence and hence overreliance is placed upon it. The Applicant believes a frequency should be based on scientifically based (accepted) statistics, taking local circumstances and protective measures into account.

6. The reasons for the need to provide for alternative conveyor routes were set out by the Applicant in Document 8.5 (Appendix 2). The Applicant is clear. The southern route is operationally far superior. It involves less infrastructure and minimises product degradation. Significantly, it also minimises the need for compulsory acquisition, the Applicant having secured the vast majority of the legal interests necessary to construct that route. The northern route is needed as a consented alternative having regard to a possibility that implementation of the southern route is not possible as a result of matters which come to light when intrusive ground investigation is undertaken. The alternatives are essential in order that the scheme has the confidence of funders that it will be delivered within the timeline for the York Potash Project as a whole.

7. The Applicant rejects the suggestion that there is any difference in the amount of risk associated with either route sufficient to influence the choice of route.

8. It has to be remembered that the BP CATS pipeline has been constructed, maintained and operated through a congested pipeline corridor. It does not sit in splendid isolation but lives alongside other assets in close proximity, all of whom may impact upon the pipeline when carrying out construction, repair or maintenance activities.

9. Indeed the pipeline corridor continues to accept additional pipelines as witnessed by the new SABIC pipeline which is currently under construction. The new pipeline is being constructed on the BP CATS side of the pipe rack. It is an over ground pipeline and it is noteworthy that construction vehicles travel over the BP CATS pipeline easement in connection with the construction of the new pipeline.

10. The SABIC pipeline is being constructed under the "permit to work" regime contained in the Sembcorp lease (referred to in paragraph 3 Appendix 1 to Document 8.10). The protection afforded to BP CATS within the "permit to work" arrangements is far less than that provided by the protective provisions in Schedule 9. In addition, the Deed of Grant (contained at **Appendix 2**), pursuant to which the BP CATS pipeline was laid, does not provide BP CATS with anything like the protection now afforded to the pipeline by the protective provisions in Schedule 9.

11. It is also noteworthy, when considering the BP CATS view of risk, that it made a decision to construct its pipeline within the pipeline corridor in full knowledge of the above. When it constructed its pipeline it no doubt could have chosen a different route to avoid the pipeline corridor and the proximity of other assets but it did not choose to do so. It chose that location and must have viewed it as acceptable. It is not accepted that the Applicant's proposals should be regarded as materially changing that position.

12. Whilst the argument of BP CATS appears to be based on its view that any degree of risk should be avoided if there is an alternative, this fails to have proper regard to the need (not choice) to maintain the alternatives.

APPENDIX 1

APPLICANT'S POSITION ON RISK – FAULT TREE ANALYSIS

REPORT BY ROYAL HASKONINGDHV

Fault Tree Analysis – RHDHV Review

Client: York Potash Ltd

Reference: PB1586-R015-Rev 2

Revision: 02/Final

Date: 15 December 2015

Royal HaskoningDHV

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1 Introduction

The York Potash Harbour Facilities Project is currently at a stage whereby formal consultation has been undertaken with Landowners and Third Party Asset Owners as part of the Development Consent Order (DCO) application process. The Project includes a conveyor from the Materials Handling Facility to the jetty to transport the potash. York Potash Limited (YPL) has proposed a route, referred to as the Southern route. YPL has also identified an alternative route, the Northern route, though this is not preferred as it requires more transfer towers which degrade the potash. Both these routes are close to an existing buried 36 inch high pressure gas pipeline operated by BP CATS. This is an underground pipeline within an infrastructure corridor operated by SembCorp. Within the SembCorp corridor the BP CATS pipeline is protected by an easement that varies in width from 3m to 10m.

BP CATS has stated that they are concerned about the risk that the construction of the conveyor presents to the pipeline. They have carried out a Quantitative Risk Analysis (QRA) on the proposed conveyor routes. The purpose of this document is to advise YPL on the analysis prepared by BP CATS, and in particular whether the underlying assumptions, the frequencies/probabilities and impacts/consequences are soundly based.

BP CATS has considered three alternative routes for the conveyor. The three routes are:

- Southern route;
- Northern route. This considers the BP CATS pipeline as originally shown in the DCO application, which was based on an incorrect alignment. This analysis would be applicable if the conveyor is moved so that its relationship to the pipeline is as shown in the DCO application.
- Northern route corrected which considers the corrected alignment of the BP CATS pipeline.

Table 1-1 below identifies the points raised in the associated Statement of Common Ground and the relevant sections within the report.

	POINTS THAT ARE AGREED	Report ref
1	**Method of assessment:** It was agreed that the method of assessment used by BP CATS was appropriate.	5.1
2	**Base input information:** It was agreed the base input information (statistics, references used to look at probability and sources of case information) were appropriate except as noted in 7 below.	6
	POINTS THAT ARE NOT AGREED	
3	**The principle of inherent safety in design and the application of the 'Hierarchy of Control' to risk mitigation**	5.4
4	**Intolerability of the risk presented by the Southern route**	6
5	**The level of risk mitigation that can be claimed for administrative controls (in the form of the protective provisions)**	5.4
6	**The impact of over familiarisation and normalisation of risk on human error rate for repetitive activities**	5.3
7	**Base input information with respect to the risk presented by vehicle movements in the pipeline corridor**	6

Table 1-1: Statement of common ground

2 Royal HaskoningDHV's expertise

This report has been prepared by Royal HaskoningDHV's Business Unit HSE Consultancy. This RHDHV unit comprises around 160 staff and is an international consultancy and engineering group providing services and sustainable solutions in the area of Health, Safety and Environment. Services include HSE management consultancy, advice, design and engineering ('technical safety'), project HSE management, contract HSE management and operational HSE management.

The unit has been active in the field of risk and safety management since the early eighties, serving national and international clients. It brings the following strengths to risk management and safety projects:

- Established contacts with key players within the EU in the field of safety management and especially industrial safety, major hazards (Seveso), Qualitative and Quantitative Risk Assessment (QRA), including Bow-tie analyses and Fault Tree analyses.
- Profound knowledge and a long-standing experience in international projects, risk management, and industrial safety in particular.
- Major European industrial safety consultant in mining, oil, gas and (petro) chemical industry.

RHDHV covers the full range of the major hazard assessment field from policy development to practical implementation and capacity building. Clients are from industry, governmental institutions and scientific institutes. Activities such as institutional development, implementation of legislation and proposing adaptations in these as well as raising of (industrial) awareness are important parts of many of RHDHV's international projects.

Figure 2-1 Some of RHDHV's clients in the petrochemical industry

3 Background to Risk Assessments

3.1 Statutory framework

HSE Guidance 'Reducing Risks, Protecting people: HSE's decision-making process', 2001 (known as R2P2) provides guidance on the tolerability of risks. It sets out how the statutory bodies responsible for the administration of the Health and Safety at Work Act 1974 ('the HSW Act') should approach the decisions about the management of risk that are required of them under the Act.

A major purpose of R2P2 is to set out an overall framework for decision taking by HSE which would ensure consistency and coherence across the full range of risks falling within the scope of the Health and Safety at Work Act. This framework was based on the method which HSE applies to the control of risk at nuclear power stations, originally published in 1988 as 'The tolerability of risks from nuclear power stations (TOR)'.

3.2 Criteria for reaching decisions

The HSE framework for tolerability of risk (the 'framework') is illustrated in Figure 3-1.

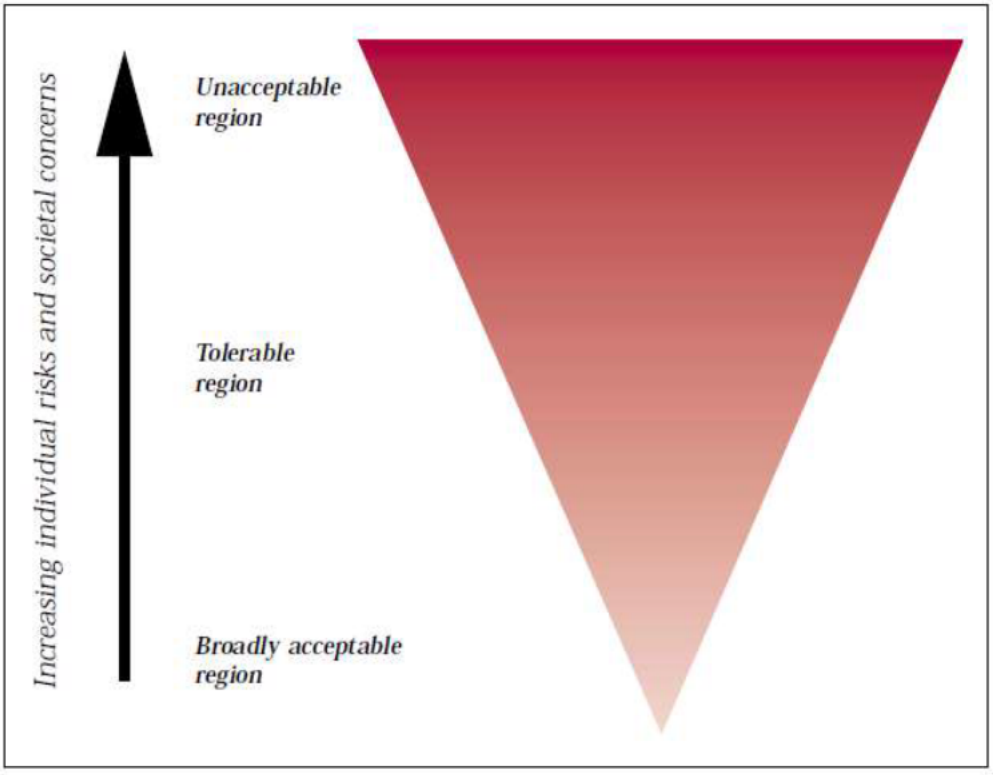


Figure 3-1 HSE Framework for the tolerability of risk - Source R2P2

The triangle represents increasing level of 'risk' for a particular hazardous activity (measured by the individual risk and societal concerns it engenders) as we move from the bottom of the triangle towards the top. The dark zone at the top represents an unacceptable region. For practical purposes, a particular risk falling into that region is regarded as unacceptable whatever the level of benefits associated with the activity.

The light zone at the bottom, on the other hand, represents a broadly acceptable region. Risks falling into this region are generally regarded as insignificant and adequately controlled. Regulators would not usually require further action to reduce risks unless reasonably practicable measures are available. Nonetheless, duty holders must reduce risks wherever it is reasonably practicable to do so or where the law so requires it.

The zone between the unacceptable and broadly acceptable regions is the tolerable region. Risks in that region are typical of the risks from activities that people are prepared to tolerate in order to secure benefits, in the expectation that:

- the nature and level of the risks are properly assessed and the results used properly to determine control measures. The assessment of the risks needs to be based on the best available scientific evidence and, where evidence is lacking, on the best available scientific advice;
- the residual risks are not unduly high and kept as low as reasonably practicable (the ALARP principle); and
- the risks are periodically reviewed to ensure that they still meet the ALARP criteria, for example, by ascertaining whether further or new control measures need to be introduced to take into account changes over time, such as new knowledge about the risk or the availability of new techniques for reducing or eliminating risks.

3.3 Tolerability limits

The framework just described can in principle be applied to all hazards. When determining reasonably practicable measures for any particular hazard, whether the option chosen to control the risk is good enough or not depends in part on where the boundaries are set between the unacceptable, tolerable or broadly acceptable regions in Figure 3-1.

HSE believes that an individual risk of death of one in a million per annum for both workers and the public corresponds to a very low level of risk and should be used as a guideline for the boundary between the broadly acceptable and tolerable regions (reference R2P2, section 130 p45). We live in an environment of appreciable risks, which contribute to a background level of risk – typically a risk of death of one in a hundred per year averaged over a lifetime. A residual risk of one in a million per year is extremely small when compared to this background level of risk. Indeed many activities which people are prepared to accept in their daily lives for the benefits they bring, for example, using gas and electricity, or driving a car, entail or exceed such levels of residual risk.

3.4 Risks giving rise to societal concerns

Developing criteria on tolerability of risks for hazards giving rise to societal concerns is difficult. Hazards giving rise to such concerns often involve a wide range of events with a range of possible outcomes. The summing or integration of such risks, or their mutual comparison, may call for the attribution of weighting factors for which, at present, no generally agreed values exist as, for example, the death of a child as opposed to an elderly person, dying from cancer, or the fear of affecting future generations in an irreversible way.

Nevertheless, HSE has adopted criteria for addressing societal concerns arising when there is a risk of multiple fatalities occurring in one single event. These were developed through the use of so-called FN-curves (obtained by plotting the frequency at which such events might kill N or more people, against N).

The technique provides a useful means of comparing the impact profiles of man-made accidents with the equivalent profiles for natural disasters with which society has to live.

Where societal concerns arise because of the risk of multiple fatalities occurring in one event from a single major industrial activity, HSE proposes the following basic criterion for the limit of tolerability -the risk of an accident causing the death of 50 people or more in a single event should be regarded as intolerable if the frequency is estimated to be more than one in five thousand per annum (reference R2P2).

4 BP CATS' Risk analysis

BP CATS has stated that they are concerned about the risk that the construction of the conveyor could damage their pipeline. They have prepared a Quantitative Risk Assessment (QRA) using a Fault Tree analysis, which is attached in Annex A and Annex B.

BP CATS has identified the construction activities for the conveyor that present a possible risk, for example piling. For each activity BP CATS has identified a list of possible events (e.g. piling rig collapse) and errors (e.g. setting out error). Probabilities are assigned to these events and errors.

For each event and error BP CATS has assessed the likelihood of a full bore rupture of the pipeline and a minor leak. They then assess the likelihood of the leak igniting. Combining all the probabilities gives the likelihood of an ignition. The effect of the ignition, i.e. the number of people affected, is then considered.

The results of BP CATS' analysis are summarised below. The analysis is based on construction taking one year, which is reasonable, i.e. the number of events per year is actually the number of predicted events for the construction. Based on this analysis, BP CATS is maintaining an objection to the southern route for the conveyor.

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

Table 4-1 Summary of the results of BP CATS risk analysis

The frequency of the outcome In Table 4-1 should be compared with the HSE guidelines. For multiple on and off site fatalities, any risk above 1 in 5,000, i.e. 2E-04, is intolerable. To be acceptable, risks of a fatality have to be less than one in a million, i.e. less than 1E-06. Using BP CATS' calculated risks, the Southern route is not tolerable, but the Northern route is tolerable.

Table 4-2 gives a breakdown of the figures for multiple on and off site fatalities. (These are caused by a rupture of the pipe and the gas igniting.) This clearly shows that the main risk identified by BP CATS is that from piling, and in particular an error in setting out resulting in either the contractor trying to install a pile through the pipe, or damaging it when excavating. The other hazards are all tolerable.

Activity/events/errors	Southern Route		Northern Route		Corrected NR	
	Frequency	[%]	Frequency	[%]	Frequency	[%]
Piling, principally error in pipeline position resulting in excavation or piling though pipe.	7.92E-04	96%	5.06E-06	94%	1.69E-05	81%
Lifting adjacent to pipeline, various errors and failures	6.48E-07	0%	2.43E-08	0%	3.68E-06	18%
Excavation to uncover pipeline, dig too deep or impact during backfilling	1.68E-05	2%	3.00E-07	6%	3.00E-07	1%
Vehicle strikes other above ground pipeline	1.24E-05	2%	NR		NR	
Vehicle strikes other above ground pipeline	6.93E-07	0%	NR		NR	
Total	8.23E-04	100	5.39E-06	100	2.09E-05	100

Table 4-2 Breakdown of BP CATS risk for multiple on and off site fatalities

Table 4-3 provides a breakdown of BP CATS' risk analysis for multiple on site only fatalities. (These are caused by a minor leak igniting.) Again the piling risk is dominant for the Southern conveyor route.

Activity/events/errors	Southern Route		Northern Route		Corrected NR	
	Frequency	[%]	Frequency	[%]	Frequency	[%]
Piling, principally error in pipeline position resulting in excavation or piling though pipe.	1.98E-03	78%	2.03E-05	27%	6.75E-05	32%
Piling, principally vibration	3.96E-04	16%	2.97E-05	40%	9.90E-05	47%
Lifting adjacent to pipeline, various errors and failures	1.62E-06	0%	9.72E-08	0%	1.47E-05	7%
Lifting adjacent to pipeline, still buried, dropped load, crane collapse	5.40E-05	2%	8.10E-06	11%	1.47E-05	7%
Excavation to uncover pipeline, dig too deep or impact during backfilling	4.20E-05	2%	1.20E-06	2%	1.20E-06	1%
Excavation to uncover pipeline, causes pipeline to settle	2.10E-05	1%	6.00E-06	8%	6.00E-06	3%
Traffic crossing pipeline, error in protection.	2.70E-05	1%	9.00E-06	12%	9.00E-06	4%
Vehicle strikes (other) above ground pipeline	1.73E-06	0%	NR	NR	NR	
Total	2.52E-03	100	7.43E-05	100	2.12E-04	100

Table 4-3 Breakdown of BP CATS risk for multiple on site fatalities

5 Review of BP CATS' Analysis

5.1 Method adopted

The Fault Tree analysis combined with event tree analysis is a generally used method within the pipeline industry. The method is used to understand how systems can fail and to gauge the probability of a safety accident. This is a quantitative method of analysis.

This method depends highly on the quality of the input data. Often the available input data is generic or is based on very limited data. Therefore the calculated probabilities should be treated as only a guide, and not a precise science. It does however provide a basis to make a proper assessment between different causes of an event in order to identify and assess mitigating measures and it is agreed that the method of assessment used by BP CATS is appropriate.

5.2 Review of BP CATS' analysis

We have undertaken a detailed review of BP CATS fault tree analysis. We have a number of comments, and Annex D gives a detailed list.

The list in Annex D can be summarised in two main comments:

- The Human Factor for the southern conveyor piling is overstated.
- The analysis does not take into account the proposed mitigation measures.

The increase in risk of the Southern Route is outweighed by the significant operational benefits associated with it. These include but are not limited to the minimisation of product degradation, reduced energy demands, reduced maintenance requirements and hence improved operational safety of employees

The Human Factor and the effects of the proposed mitigations measures are discussed below.

5.3 Human factor

The human error probability is generally assumed to be 0.001. This means the probability of an error being made is 1 in 1,000 (0.001 per opportunity). This value is generally applied for simple routine operations and/or well trained operators/operatives with no stress and independent verification. We therefore agree that this value is applicable for human error frequency for a single operator in general.

However, within the BP CATS analysis the probability has been increased by a factor of 10 for piling near the southern conveyor route, because of the repetitive nature of the activities, i.e. the probability is 1 in 100. (Note that this applies to each piling point. With 120 piling locations, the probability is multiplied by 120, meaning that on average one expects 1.2 errors.)

We do not consider that the work is repetitive because:

a) Piling is not a simple routine operation performed by a single operator.

b) The (120) piling activities are scheduled over a period over multiple months.

c) Piling is executed by specialist contractors, well trained and applying particular mitigation measures in order to minimize risks of complacency.

In addition complacency would be offset by familiarity with the task and therefore no increase is justified. In BP CATS' analysis, an additional factor has been applied and thereby overstating the actual risk associated with human error and has a major impact on the overall result of the analysis as this risk accounts for 96% of predicted events of multiple on and off site fatalities for the Southern route (see Table 4-2). Just removing the additional factor, even without the additional mitigation measures discussed below, reduces the overall likelihood of multiple on and off site fatalities by 79%, bringing the overall risk into the HSE defined tolerable range.

There will be multiple layers of supervision (including BP CATS, YPL with their supervisor, YPL's contractor and Sembcorp). Failure is less likely to occur because it requires two or more human errors within different organisations. BP CATS has not increased the human factor for the Northern route, as there are fewer relevant piling locations.

5.4 Effect of proposed mitigations

We consider that the protective provisions are acceptable engineering and administrative measures permitted by the principles of Hierarchy of Control and will substantially reduce the risks. We do not therefore consider that the proposed mitigation measures as described in Constructability Notes PB1586-N029 and N030 for the Northern and Southern Routes have been properly taken into account in BP CATS' analysis.

For the piling (the dominant risk) the following mitigation is proposed:

- Initial location of pipeline to be ascertained by referring to the asset owner's drawings and to be verified by other means.
- Requirement to expose the crown of the pipeline by hand digging.
- Requirement to confirm the location of the pipeline in the presence of the asset owner.
- Requirement for excavating at the location to ensure no potentially vulnerable assets are present.
- If necessary: physical separation between the asset and pile/excavations (to be agreed with the asset owner).
- Requirement to pre-plan the location, timing and duration of works to give the asset owner (BP CATS) enough time to comment.

As a result of these proposed mitigation measures, we consider that in this case at least two human errors would need to occur before a specific error (e.g. error in pipeline position, error in crane position, error in operating excavation machinery etc.) can occur. Therefore the probability should be reduced from 1 in 1,000 to 1 in 1,000,000.

Similarly we consider that for other risks that require a setting out error, two human errors will be required, i.e. the initial error and the error as a result of all the check procedures not picking up the initial error.

6 Our revised analysis

We have revised the fault tree analysis to take into account our comments, and this is included in Annex C. All corrections to the Fault Tree input have been marked with green text/beige background with revised corrected results identified with a green box and white text.

The base input information used by BP CATS (statistics, references used to look at probability and sources of case information) is considered appropriate except for the following points where principal corrections were made:

- Generally human failure based probabilities are based on two errors being required rather than one, in view of the mitigation proposed. This has the most significant effect on the result;
- The enhanced human error factor of 10 for the piling operation on the southern route, due to complacency, has been deleted.

We have not undertaken a detailed reassessment based the non-human factors as these will not alter the risk level substantially.

The table below compares the results from BP CATS to those of RHDHV after the impact of the revised human factors has been applied.

The yellow marked cells indicate the highest risk level for on and off site fatalities. The red marked cells indicate the highest risk level for on-site fatalities.

Activity	Fatalities Outcome	Southern route		Northern route		NR, corrected	
		BP CATS assessment	RHDHV assessment	BP CATS assessment	RHDHV assessment	BP CATS assessment	RHDHV assessment
1.Piling	C1 on/off site	7.92E-4	1.44E-7	5.06E-6	6.75E-9	1.69E-5	2.25E-8
	C3 on site	1.98E-3	3.60E-7	2.03E-5	2.70E-8	6.75E-5	9.00E-8
	C6 on site	3.96E-4	7.20E-7	2.97E-5	5.40E-8	9.90E-5	1.80E-7
6.Lifting	C9 on/off site	6.48E-7	2.16E-7	2.43E-8	1.05E-8	3.68E-6	3.38E-8
	C11 on site	1.62E-6	5.40E-7	9.72E-8	4.20E-8	1.47E-5	1.35E-7
	C14 on site	5.40E-5	5.40E-7	8.10E-6	4.20E-8	1.47E-5	1.35E-7
15.Excavation	C17 on/offsite	1.68E-5	1.68E-8	3.00E-7	3,00E-9	3.00E-7	3,00E-9
	C19 on site	4.20E-5	4.20E-8	1.20E-6	1.20E-8	1.20E-6	1.20E-8
	C22 on site	2.10E-5	2.10E-8	6.00E-6	6.00E-9	6.00E-6	6.00E-9
19.Traffic	C25 on site	2.70E-5	2.70E-8	9.00E-6	9.00E-9	9.00E-6	9.00E-9
21 Vehicle	C28 on/off site	1.24E-5 (unchanged)		not relevant		not relevant	
	C29 on/off site	6.93E-7 (unchanged)		not relevant		not relevant	
	C31 on site	1.73E-6 (unchanged)		not relevant		not relevant	

Table 6-1 Comparison of the RHDHV assessment to BP CATS assessment

For the RHDHV assessment, all outcome frequencies with the exception of vehicle strikes are below 1 in 1 million (1E-6), which is less than 1% of the tolerable level (threshold value of 1 in 5,000 (2E-4) for 50 fatalities).

The outcome frequency for vehicle strikes is less than 10% of the threshold value for tolerable level. (This incident involves a vehicle striking an above ground pipeline, causing the pipeline to fail, the release ignites and hence damages the main gas pipeline.) However we think both the frequency and the probability of the consequences are probably over-estimated. BP CATS' analysis is based on very limited data on accidents, namely one occasion with above ground product lines on BP premises. There are also significant uncertainties with regard to the probability that a vehicle strike results in damage to the main pipeline.

In the BP CATS Fault Tree the piling operations are a greater risk than the lifting operations. If mitigation measures are considered, lifting and piling have about the same risk level in the Fault Tree reassessed by RHDHV. The highest levels are marked in the table, but they are of the same magnitude. In the original fault tree of BP CATS the risks due to piling were far more important than the risks due to lifting.

According to R2P2, risks are defined as acceptable, tolerable or intolerable. Most of the revised risks are considered acceptable with the balance considered as tolerable and they are therefore within the HSE threshold for intolerable risks of 1 in 5,000.

7 Conclusions

The conclusions of the assessment are:

1. That BP CATS' method of assessment is appropriate,

2. BP CATS has not considered the mitigation measures described in the constructability notes (PB1586 N029 and PB1586 N030). Based on the principles of Hierarchy of Control the application of these mitigation measures is an accepted method of risk reduction when risk elimination is not an appropriate method. We consider that these mitigation measures substantially reduce the chances of human error, and therefore substantially reduce the probability of an incident. There will be multiple layers of supervision (including BP CATS, YPL's supervisor, YPL's contractor and Sembcorp). Failure to properly implement the protective provisions is unlikely as it would require two or more errors of supervision within different organisations.

3. The revised analysis by RHDHV, using the same input data with the corrected human factor and mitigation defined in the constructability notes concludes that the risks are substantially less. The difference in risk is illustrated with the following table:

Multiple fatalities on/off site	BP CATS	YPL	BP CATS	YPL
	Southern		Corrected Northern	
Activity/events/errors	Freq	Freq	Freq	Freq
Total	*8.23E-04*	*1.35E-05*	*2.09E-05*	*5.93E-08*

   Risks are defined by the HSE as being "Acceptable" (with risk of a fatality per year below 1E-06), "Unacceptable" (with risk of a fatality per year above 2E-04) or "Tolerable" (between these two limits). We therefore consider that the risk associated with the Southern route is "Tolerable" and the Northern Route is "Acceptable".

4. Although the Southern route has an increased risk when compared to the Northern route, it is still below the HSE guidance threshold. The increased risk of the Southern Route is outweighed by the significant operational benefits associated with it.

5. BP CATS has increased the likelihood of human error on the Southern conveyor piling by a factor of 10. This is because they consider that the contractor will become complacent due to the repetitive nature of the task (there are120 piling points). YPL does not consider that the piling work is repetitive because it is not a "routine" task in the generally accepted meaning of the term. The piling activities are scheduled over a period over multiple months and executed by specialist contractors applying particular measures to minimise complacency. The potential additional risk for complacency would be offset by improved familiarity with the task. BP CATS use of an increased multiplication factor of 10 for this concern is not justified and distorts the results of their QRA making the overall risk 'Intolerable' in accordance with HSE guidance.

6. For the risk related to a vehicle striking an above ground pipeline, which could happen on the Southern conveyor route, the calculated probability is less than 1 in 80,000. This is still substantially less than the HSE threshold. In any case we suspect that this risk has been overstated, noting that the probabilities are based on very limited data.

7. In summary we therefore consider that the risks are Tolerable or lower for both the Southern and Northern routes.

Annex A - Fault Tree Notes prepared by BP, dated 15th December 2015

Fault Tree Notes

1. Introduction

Three fault trees are produced:

Southern route Construction phase, based on the original drawings from York Potash. It is assumed that the construction phase carries the greatest risk of a release from the CATS 36" pipeline.

Northern Route Construction phase, based on the original layout drawings as received from York Potash. However it has been identified that there is an error in the representation of the CATS pipeline for the northern route, which affects the release frequency. This version of the analysis will be valid if York Potash re-route their conveyor based on the correct pipeline position to minimise interaction with the pipeline

Northern Route Construction phase Corrected. This is based on the corrected pipeline position and the revised York Potash drawing received on 21/10/15. In reality, the dog-leg in CATS pipeline on the northern route occurs further north-east along the conveyor, close to the second conveyor tower. This results in an additional distance where the conveyor is adjacent to or directly above the pipeline, assuming that York Potash do not re-route their conveyor

Many of the activities, errors and other failure frequencies are common to all three analyses. Any differences are highlighted in these notes

2. Piling Activities (Fault tree Ref 1)

It is assumed an excavation is required at each piling location to provide footings, so piling and excavation activities are not independent - e.g. if the pipeline position is correctly identified when the excavation is carried out, it is highly unlikely there will be an error in the piling location. Hence excavation of pile footings and piling are considered as one activity.

Excavation as a cause in its own right is considered separately below as it is highly likely that BP will request that the pipeline is uncovered (either sections or in its entirety)

2.1 Southern route

120 piling locations identified, so frequency of 120 events per year. All piles considered to be 'adjacent' to the pipeline

2.2 Northern route

18 piling locations identified, Some piling locations are >12m away from the pipeline, so only those on the side of the conveyor closest to the pipeline are considered to be a real risk, so frequency of 9 events per year.

2.3 Corrected Northern Route

There are 38 piling locations along the northern route where the conveyor is in the vicinity of the pipeline, however only 30 piling locations are considered to be adjacent to the pipeline.

Hence frequency of Fault tree ref 1 changes from 9 to 30 events per year

3. Lifting Activities (Fault tree Ref 6)

Assume 1 lift per piling location, plus 1 lift per section of conveyor

3.1 Southern route

120 piling locations identified, plus 60 sections of conveyor so frequency of 180 lifts per year.

3.2 Northern route

18 piling locations identified, plus 9 sections of conveyor so frequency of 27 lifts per year.

3.3 Corrected Northern Route

There are 30 piling locations and 19 sections of conveyor

Hence frequency of Fault Tree Ref 6 changes from 27 to 49 lifts per year

4. Excavations (Fault tree Ref 15)

As discussed above, excavations for pile footings are not independent of piling activities, so are considered with the piling.

It is likely that sections of the pipeline will be uncovered, so there are specific excavation activities that can impact the pipeline.

The excavations could be one continuous activity to uncover the pipeline where it is immediately adjacent to the conveyor route, or a series of discrete excavations to uncover certain sections. Due to this uncertainty, the number of pipeline orientations is taken as the number of discrete excavations. This assumes that once one part of the pipeline has been uncovered with it in a particular orientation, then subsequent identification of the pipeline position will be relatively easy and the chance of an error is negligible, until the pipeline changes direction, when the chance of an error returns.

4.1 Southern Route

7 orientations due to dog-leg and small changes in direction

4.2 Northern route

2 orientations around the dog-leg

4.3 Corrected Northern route

This is unchanged from the original northern route at 2 orientations as there is still a single dog leg

5. Traffic and pipeline crossings (Fault tree Ref 19)

Based solely on number of crossing points where traffic will be driving over the top of the pipeline. No attempt to quantify number of journeys

5.1 Southern Route

3 identified crossing points

5.2 Northern Route

1 identified crossing point

5.3 Corrected Northern Route

Remains unchanged from the original northern route at 1 crossing point, though the location moves

6. Human error (Fault tree Ref 2, 3, 7, 16, 17)

Wrong location chosen resulting in piling, excavation work or crane siting on top of the pipeline when it is believed to be away from the pipeline

It is noted that for the northern route there is generally more freedom and space for siting of piling rigs / cranes etc outside the pipeline easement. The southern route is generally more congested with above and below ground pipelines with far less space for siting equipment. It would be reasonable to assume that the magnitude of any error resulting in the pipeline being struck on the northern route is greater than for the southern route, where a discrepancy of 0.5 - 1m could be critical. However, in this analysis no attempt is made to quantify this effect

A widely used value for human error frequency is 0.001/opportunity. This is typically for an operator who is well trained with no stress and there is independent verification of his actions.

Human error frequency for an Operator who is well trained with no stress and independent verification: 0.001/opportunity

Kirwan (ref 1) quotes 0.001/opportunity for an error in a simple routine operation

These error rates make no account of complacency or over-familiarity in routine tasks. An individual is likely to take more care with a one-off or unfamiliar task.

Complacency is cited as one of the key human error factors in aviation incidents but no attempt has been made to quantify the effect in human error rates. It is a noticeable difference between the southern and northern routes that one has over 100 piling activities in close proximity to the pipeline whilst the other has less than 10. The repetitious nature of the activities, over an extended period of time is highly likely to lead to over-familiarisation and a de-sensitisation to the hazardous nature of the work. Hence it is suggested that a factor of 10 is appropriate - a human error is 10 times more likely on the southern route than on the northern route

However, not all errors will result in an unsafe situation. It is possible that the error in pipeline location actually moves the excavation / piling location further away from the pipeline. Assume 10% of location errors result in the pipeline being exposed to excavation / piling activities

6.1 Southern route - take 0.001 unsafe error probability

6.2 Northern route - take 0.0001 unsafe error probability

6.3 Corrected Northern Route - take 0.0001 unsafe error probability

It is considered that the error frequencies are unchanged from the original northern route. Although there are more frequent piling and excavating activities adjacent to the pipeline, they are still considerably less than for the southern route.

The same argument also applies to errors in operating machinery during excavation (Fault tree Ref 16) and impacting the pipeline during backfilling. (Fault tree Ref 17)

6.4 MoC error frequency

It is expected that changes to the design of excavations or piling locations will be required as construction progresses - responding to unexpected ground conditions, layout on the ground differing from the drawings, etc. York Potash have stated that they expect to modify the design of the individual support footings as required to fit them in between easements and above ground pipelines, especially on the southern route where space is minimal.

Take human error for MoC as 0.001 for both routes as it is expected that these will be infrequent and are an unusual activity so a lower chance of an error being made (Fault tree Ref 3). However, consider that the southern route will have a greater frequency of modification - say 10%, whereas the northern route will only require 5% of excavations and piling needing to be moved.

6.5 Supporting Incidents and Experience

Buried gas pipeline in Belgium which exploded in July 2004 killing 24 people had been damaged by a ground compactor

One error in pipeline routing on the York Potash drawings identified during the HAZID

BP CATS has experience of a 3rd party carrying out excavations over the CATS pipeline during construction of a new above ground line, whilst under Sembcorp permit to work

7. Probability of full bore rupture vs minor leak vs no leak (Fault tree Ref A)

This is to establish what happens to the pipeline once it is impacted - whether it fails catastrophically in a full bore rupture, or whether a minor leak (e.g. a crack or small hole) occurs, or whether the pipeline remains intact.

Data on this is difficult to find as publically available failure rates include the probability of the pipeline being impacted. However, they do shed some light on the relative frequencies of small leaks and full bore ruptures

EGIG (ref 2) quotes 0.016 ruptures per 1000km of pipeline per year, 0.135 minor leaks per 1000km of pipeline per year from holes, pinholes and cracks

UKOPA (ref 3) quotes 191 incidents, of which 7 were full bore or greater

From this, take probability of a rupture as 10-20 times less likely than that of a small leak.

The nature of the impact needs to be considered

It is acknowledged that the piles will be bored piles (not driven) However, if the pipe is impacted by the auger, the auger will continue to bore into the pipeline, so there is a chance that the pipeline will lose containment. Also consider that the pile diameter is approx 350mm and a full bore rupture is perhaps more likely if the pipeline is struck by the auger

Hence impact from piling: 0.05 full bore rupture, 0.5 minor leak, 0.45 pipeline damaged but no loss of containment

If the exposed pipeline is impacted whilst lifting, excavating or backfilling, it is far more likely to be a single blow rather than the continuous drilling from an auger. In fact it is considered highly unlikely that these activities will lead to a full bore rupture - a minor leak or no leak at all is probable

Hence impact from dropped load, excavation or backfilling: 0.01 full bore rupture, 0.1 minor leak, 0.89 pipeline damaged but no loss of containment

If the pipeline is buried and suffers an impact, from a load drop, a crane or piling rig collapse or piling vibration, it is not considered credible that a full bore rupture will occur

Hence impact from other causes: 0.1 minor leak, 0.9 pipeline damaged but no loss of containment

8. Ignition probabilities (Fault tree Ref B)

Widely used ignition probabilities in Layer of Protection Analysis are:

Immediate ignition: 0.3 for high energy mechanical impact, 0.1 otherwise

UKOPA (ref 3) - only 9 out of 191 incidents resulted in ignition

EGIG (ref 2) - 32% of releases in pipelines >16" diameter result in ignition, 5% for all releases

Pinhole crack / hole = 4.4 - 2.3%. Suggest use 0.03 for minor leak ignition probability

Use 0.3 for FBR, 0.03 for minor leak

NB - no account of the increased number of ignition sources due to the construction site, so these figures are conservative.

9. Population present and affected (Fault tree Ref C)

Affected populations include supermarket and car distribution warehouses, plus a sewerage works. These are all considered to employ shift workers, but there would be a reduced population during night hours. The trunk road (affected by the northern route) will also have a reduced population at night. However it is considered that major activities such as piling, lifting or excavating will take place in daylight hours only, when the full population is present. Hence probability of population present = 1 for both routes

There is also the probability that the incident occurs at a location on the pipeline where all the populations can be affected - if the pipeline is struck and ruptures at the western end, near the river, the resulting fire will not affect the sewerage works. There will still be offsite effects and potential casualties, but the number of fatalities will be diminished

Southern route: By inspection of the pipeline, this is estimated to be 40%, so probability of the release affecting the full population = 0.4

Northern route, the trunk road and sewerage plant will be affected from all potential rupture locations, so probability of the release affecting the full population = 1

Also consider the direction of the jet fire following full bore rupture. The modelling predicts that the radiation contours are virtually circular, so regardless of the orientation, populations are affected by radiation, even if the flame is directed 180 degrees away from them. (I.e. it is does not require direct impingement of the flames for fatalities to occur) This is particularly relevant for the southern route, where the populations are close to the pipeline on either side of it. Most likely failure location will be in the top quadrant of the pipe so the flame will be vertically upwards or at an angle to the horizontal. Hence there is no additional reduction for leak rupture orientation on the southern route

However for the northern route (both original and corrected), the trunk road is at the extremity of the affected area, so a factor of 0.25 is appropriate - the full population is only affected by a jet fire directed towards or above the trunk road

Southern route, probability that fire affects full offsite population = 1

Northern route, probability that fire affects full population = 0.25

10. Traffic incident (Fault tree Ref 21)

Supporting Experience

BP CATS has experience of a 3rd party reversing a van towing a welding set into one of the CATS above ground product lines. On that occasion the pipeline was knocked off its supports but there was no loss of containment. One event in 15 years of operation

Take 1 in 30 years for frequency of a traffic event

11. Secondary Events (Fault tree Ref 4, 8, 9, 18, 20)

11.1 Excessive vibration during piling (Fault tree Ref 4)

Considered to be an issue if a human error is made in the vibration modelling or in carrying out the geological survey. Hence use 0.001

11.2 Crane foundation failure or punch-through (Fault tree Ref 8 & 9)

Considered to be an issue if a human error is made in the foundation design or in carrying out the geological survey. Hence use 0.001

11.3 Design or placement of protection for the pipeline from vehicles (Fault tree Ref 20)

Considered to be an issue if a human error is made in the protection design, setting it out, or in directing the traffic. Consider these to be 3 distinct phases of the activity so errors are independent Hence use 0.001 x 3 = 0.003

11.4 Settlement of pipeline around excavations (Fault tree Ref 18)

Considered to be an issue if a human error is made in the excavation design or in carrying out the geological survey. Hence use 0.001

11.5 Piling Rig and Crane collapse (Fault tree Ref 5, 12 & 14)

Noted that the work will involve temporary crane siting away from roads.

Use 0.0001 for both routes, same as probability of a dropped load

11.6 Dropped Load (Fault tree Ref 11 & 13)

Use 0.0001 for both routes

CCPS LOPA guidance (ref 4) is to use $1x10^{-4}$ per lift for a dropped load from a crane

Report 'A Survey of Crane Operating Experience at U.S. Nuclear Power Plants from 1968 through 2002' by the U.S. Nuclear Regulatory Commission reports 10 dropped loads in 34 years during construction activities

OGP Risk Assessment Data Directory March 2010 'Mechanical Lifting Failures' quotes offshore dropped object rate of 1.5×10^{-5} for all weights and all cranes, but cautions that the data is not applicable to onshore use

11.7 Pipeline exposed (Fault tree Ref 11, 12, 13, 14 & 24)

Considered that one of the BP requirements is likely to be that the pipeline is exposed, but not all pipeline may be exposed when lifting activities take place, hence assume 0.5 probability that the

pipeline is exposed at the time of a dropped object, crane collapse or rupture of a 3rd party above ground pipeline

But also consider that if the pipeline is exposed, there will be protection provided for it in the terms of crash mats / structures. However, given the size of some of the lifts it is debatable whether any protection would be sufficient

For both routes take a further 0.01 probability that the exposed pipeline is not protected (either error in the location or design of the protection)

12. Failure of above ground pipeline adjacent to CATS pipeline (Fault tree Ref 22 - 27)

Applies only to Southern route

Rupture of above ground pipeline (Fault tree Ref 22 & 26)

Take 0.05, same as for rupture of CATS pipeline (conservative as these are thinner pipes)

Ignition probability (Fault tree Ref 23 & 27)

Likely releases are liquid propane or butane which would form a vapourising pool, potentially igniting immediately to form a jet fire or pool fire, or if there is delayed ignition, a vapour cloud explosion is possible.

Immediate ignition and fire = 0.3 (as for CATS pipeline release as this is a high energy impact)

Delayed ignition and a VCE = 0.5 (widely used value in Layer of Protection Analysis)

Impingement of a fire on CATS pipeline

Take 0.25, noting that a pool fire is likely to spread to the CATS pipeline, but jet fire can occur in any direction

In the event of a fire impinging on the CATS pipeline, there will be a time delay before it fails, so evacuation of the site and possibly the local off-site population would be possible before the pipeline failed, so the probability of significant numbers of fatalities is further reduced. However, this is not included in the analysis as this cause is already a negligible frequency when compared to other causes

13. Exclusions from the Fault Tree

Hazards identified in the HAZID which have not been included in the fault tree:

Deliberate violation of pipeline markers - negligible frequency compared to other causes

Damage to pipeline Cathodic Protection system - negligible frequency compared to other causes

Security issue leading to terrorist attack on pipeline - negligible frequency compared to other causes

14. Public References

1. A Guide to Practical Human Reliability Assessment, Barry Kirwan, 1994

2. GAS PIPELINE INCIDENTS, 9th Report of the European Gas Pipeline Incident Data Group (period 1970 – 2013), Feb 2015
3. United Kingdom Onshore Pipeline Operators Association (UKOPA) Pipeline Product Loss Incidents and Faults Report (1962-2013), Dec 2014
4. Center for Chemical Process Safety: Guidelines for initiating events and independent protection layers in Layers of Protection Analysis, Feb 2015

Annex B - Fault Tree Rev 2 produced by BP, dated 4th November 2015

SUMMARY

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

Notes

Northern Route — As originally drawn, with error in pipeline position, but also applicable if York Potash re-route the conveyor to minimise interaction with pipeline

Northern Route Corrected — Pipeline position shown correctly, but with conveyor in original position

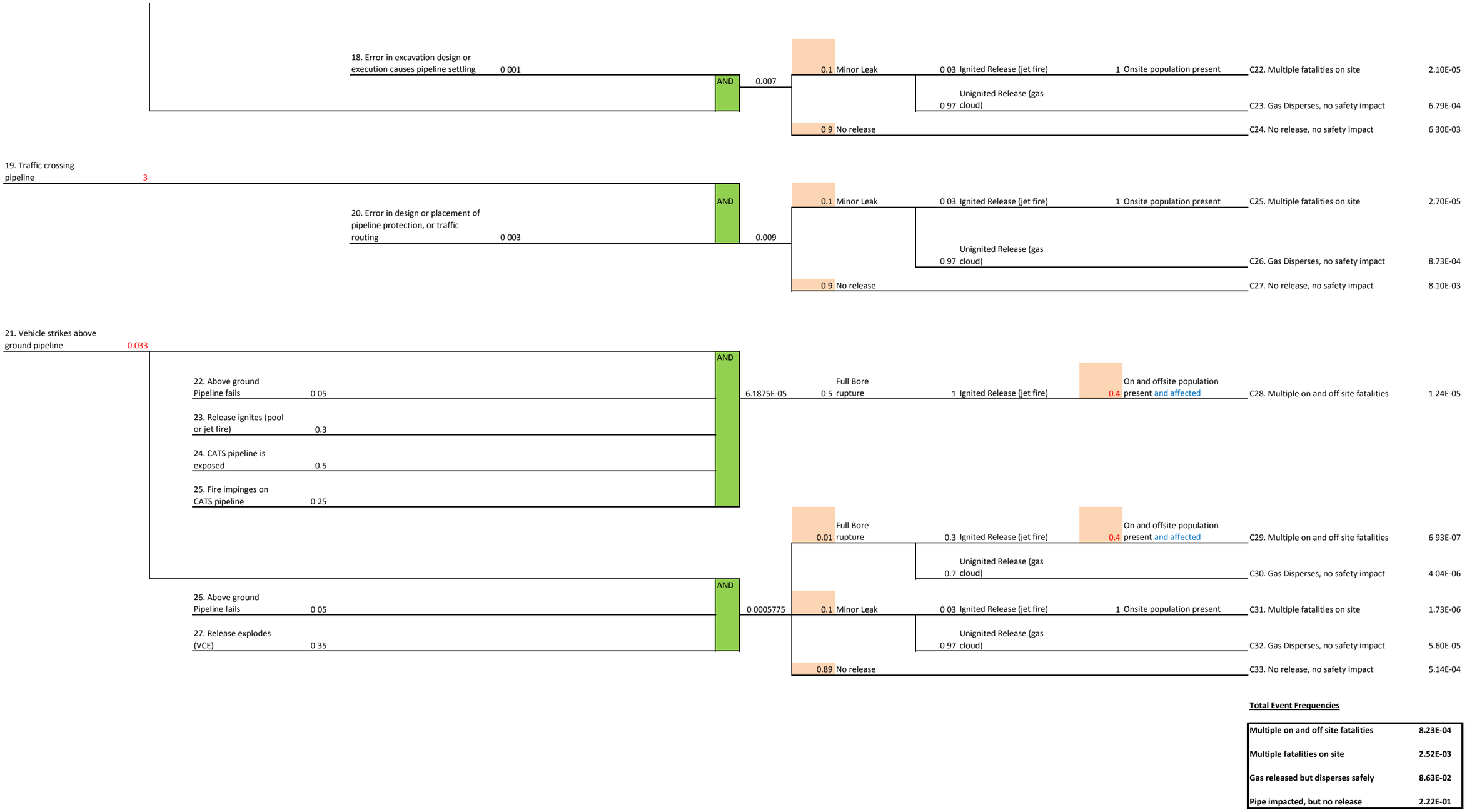
HSE Guidance 'REDUCING RISKS, PROTECTING PEOPLE: HSE's decision-making process' , 2001 (Known as R2P2) suggests an incident which has the potential to kill more than 50 people and can occur with frequency greater than 2E-04 per year is Intolerable

136 Thus, where societal concerns arise because of the risk of multiple fatalities occurring in one event from a single major industrial activity, HSE proposes the following basic criterion for the limit of tolerability, particularly for accidents where there is some choice whether to accept the hazard or not , eg the risk of such an event happening from a major chemical site or complex continuing to operate next to a housing estate. In such circumstances, HSE proposes that the risk of an accident causing the death of 50 people or more in a single event should be regarded as intolerable if the frequency is estimated to be more than one in five thousand per annum.

FAULT TREE FOR RUPTURE AND FIRE FROM CATS 36" PIPELINE AS A RESULT OF YORK POTASH CONVEYOR CONSTRUCTION ACVTIVITY

SOUTHERN ROUTE CONSTRUCTION PHASE

Activity	Freq	Event	Prob	Error	Prob	Freq of pipeline impacts	A. Rupture Prob	A. Rupture Type	B. Ignition Prob	B. Ignition Type	C. Population Prob	C. Population Description	Outcome	Freq
1. Piling (and associated excavation) adjacent to pipeline	120			2. Error in pipeline position. Excavation and subsequent piling on top of pipeline	0.001	0.132	0.05	Full Bore rupture	0.3	Ignited Release (jet fire)	0.4	On and offsite population present and affected	C1. Multiple on and off site fatalities	7 92E-04
									0.7	Unignited Release (gas cloud)			C2. Gas Disperses, no safety impact	4.62E-03
				3. Poor MoC if piling or excavation location moved	0.0001		0 5	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C3. Multiple fatalities on site	1 98E-03
									0 97	Unignited Release (gas cloud)			C4. Gas Disperses, no safety impact	6.40E-02
		4. Excessive vibration	0.001				0.45	No release					C8. No release, no safety impact	5 94E-02
		5. Piling rig collapse	0.0001											
							0.1	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C6. Multiple fatalities on site	3 96E-04
									0 97	Unignited Release (gas cloud)			C7. Gas Disperses, no safety impact	1 28E-02
							0 9	No release					C8. No release, no safety impact	1.19E-01
6. Lifting adjacent to pipeline	180			7. Error in crane / pipeline position (crane on top of pipe)	0.001	0.00054	0.01	Full Bore rupture	0.3	Ignited Release (jet fire)	0.4	On and offsite population present and affected	C9. Multiple on and off site fatalities	6.48E-07
									0.7	Unignited Release (gas cloud)			C10. Gas Disperses, no safety impact	3.78E-06
		8. Crane foundations failure	0.001				0.1	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C11. Multiple fatalities on site	1.62E-06
		9. Crane outrigger punchthrough	0.001						0 97	Unignited Release (gas cloud)			C12. Gas Disperses, no safety impact	5 24E-05
		11. Dropped Load (pipeline exposed)	0.00005				0.89	No release					C13. No release, no safety impact	4 81E-04
		12. Crane collapse (pipeline exposed)	0.00005											
		Exposed Pipeline protection fails	0 01											
		13. Dropped Load (pipeline buried)	0.00005											
		14. Crane collapse (pipeline buried)	0.00005											
							0.1	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C14. Multiple fatalities on site	5.40E-05
									0 97	Unignited Release (gas cloud)			C15. Gas Disperses, no safety impact	1.75E-03
							0 9	No release					C16. No release, no safety impact	1.62E-02
15. Excavation to uncover pipeline	7			16. Error in operating excavation machinery (dig too deep)	0 001	0.014	0.01	Full Bore rupture	0.3	Ignited Release (jet fire)	0.4	On and offsite population present and affected	C17. Multiple on and off site fatalities	1.68E-05
									0.7	Unignited Release (gas cloud)			C18. Gas Disperses, no safety impact	9 80E-05
				17. Error in backfilling operation causes impact	0 001		0.1	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C19. Multiple fatalities on site	4 20E-05
									0 97	Unignited Release (gas cloud)			C20. Gas Disperses, no safety impact	1 36E-03
							0.89	No release					C21. No release, no safety impact	1 25E-02



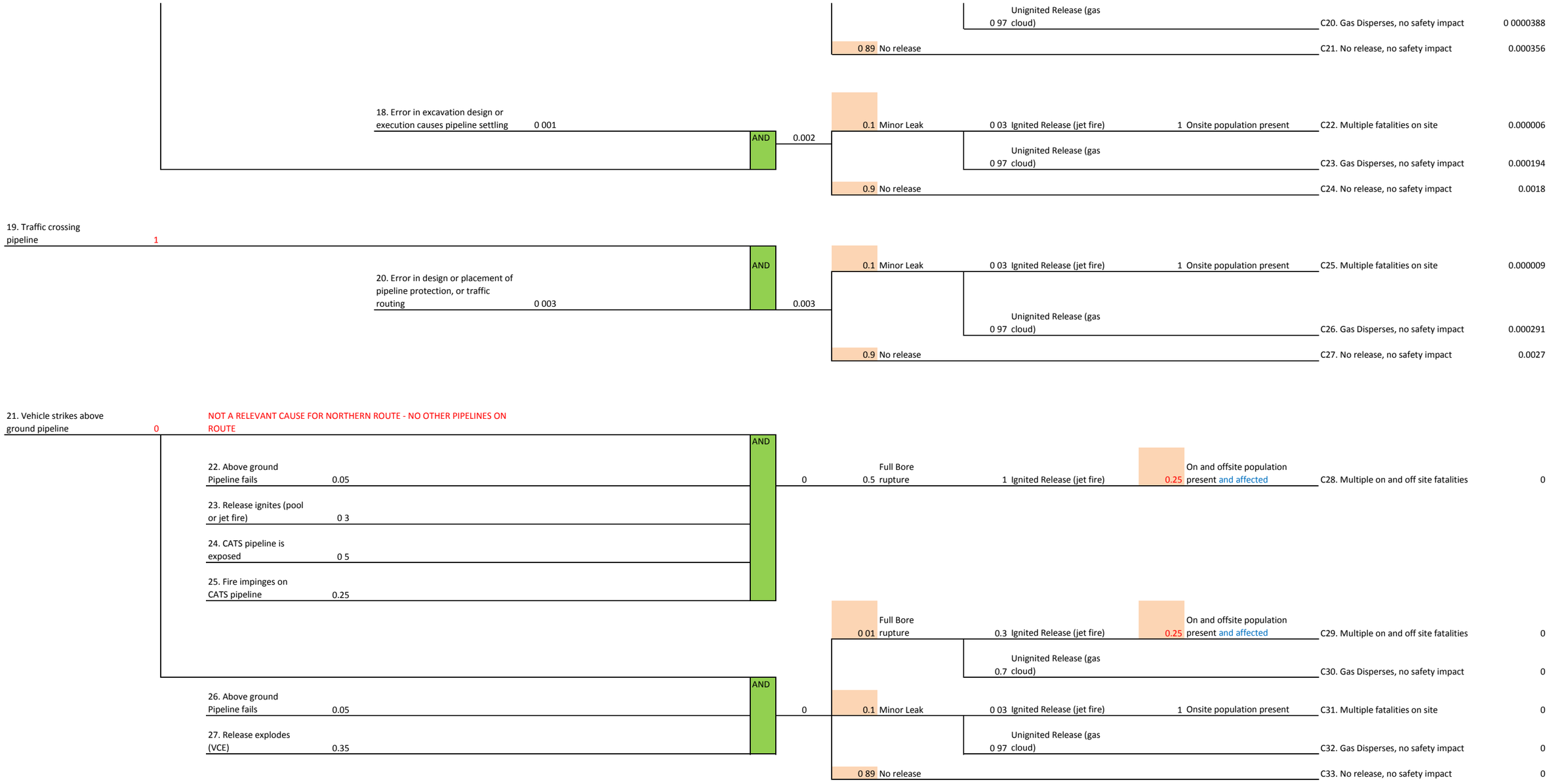
Total Event Frequencies

Multiple on and off site fatalities	**8.23E-04**
Multiple fatalities on site	**2.52E-03**
Gas released but disperses safely	**8.63E-02**
Pipe impacted, but no release	**2.22E-01**

FAULT TREE FOR RUPTURE AND FIRE FROM CATS 36" PIPELINE AS A RESULT OF YORK POTASH CONVEYOR CONSTRUCTION ACVTIVITY

NORTHERN ROUTE CONSTRUCTION PHASE

Activity	Freq	Event	Prob	Error	Prob		Freq of pipeline impacts	A. Rupture Prob	A. Rupture Type	B. Ignition Prob	B. Ignition Type	C. Population Prob	C. Population Description	Outcome	Freq
1. Piling (and associated excavation) adjacent to pipeline	9							0 05	Full Bore rupture	0.3	Ignited Release (jet fire)	0.25	On and offsite population present and affected	C1. Multiple on and off site fatalities	5 0625E-06
				2. Error in pipeline position. Excavation and subsequent piling on top of pipeline	0.0001					0.7	Unignited Release (gas cloud)			C2. Gas Disperses, no safety impact	0.00004725
				3. Poor MoC if piling or excavation location moved	0.00005	OR 0.00015	AND 0 00135	0.5	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C3. Multiple fatalities on site	0.00002025
										0 97	Unignited Release (gas cloud)			C4. Gas Disperses, no safety impact	0.00065475
		4. Excessive vibration	0 001					0.45	No release					C8. No release, no safety impact	0 0006075
		5. Piling rig collapse	0.0001	OR 0.0011			AND								
							0.0099	0.1	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C6. Multiple fatalities on site	0 0000297
										0 97	Unignited Release (gas cloud)			C7. Gas Disperses, no safety impact	0 0009603
								0.9	No release					C8. No release, no safety impact	0 00891
6. Lifting adjacent to pipeline	27							0 01	Full Bore rupture	0.3	Ignited Release (jet fire)	0.25	On and offsite population present and affected	C9. Multiple on and off site fatalities	2.43E-08
				7. Error in crane / pipeline position (crane on top of pipe)	0.0001					0.7	Unignited Release (gas cloud)			C10. Gas Disperses, no safety impact	2.268E-07
		8. Crane foundations failure	0.001			AND 2E-07	AND 0.0000324	0.1	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C11. Multiple fatalities on site	9.72E-08
		9. Crane outrigger punchthrough	0.001	OR 0.002		OR 0 0000012				0 97	Unignited Release (gas cloud)			C12. Gas Disperses, no safety impact	3.1428E-06
		11. Dropped Load (pipeline exposed)	0.00005	OR				0 89	No release					C13. No release, no safety impact	0 000028836
		12. Crane collapse (pipeline exposed)	0.00005	0.0001		0 000001									
		Exposed Pipeline protection fails	0.01	AND											
		13. Dropped Load (pipeline buried)	0 00005												
		14. Crane collapse (pipeline buried)	0 00005	OR 0.0001			AND 0.0027	0.1	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C14. Multiple fatalities on site	0 0000081
										0 97	Unignited Release (gas cloud)			C15. Gas Disperses, no safety impact	0 0002619
								0.9	No release					C16. No release, no safety impact	0 00243
15. Excavation to uncover pipeline	2							0 01	Full Bore rupture	0.3	Ignited Release (jet fire)	0.25	On and offsite population present and affected	C17. Multiple on and off site fatalities	0 0000003
				16. Error in operating excavation machinery (dig too deep)	0.0001					0.7	Unignited Release (gas cloud)			C18. Gas Disperses, no safety impact	0 0000028
				17. Error in backfilling operation causes impact	0.0001	OR 0.0002	AND 0.0004	0.1	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C19. Multiple fatalities on site	0 0000012



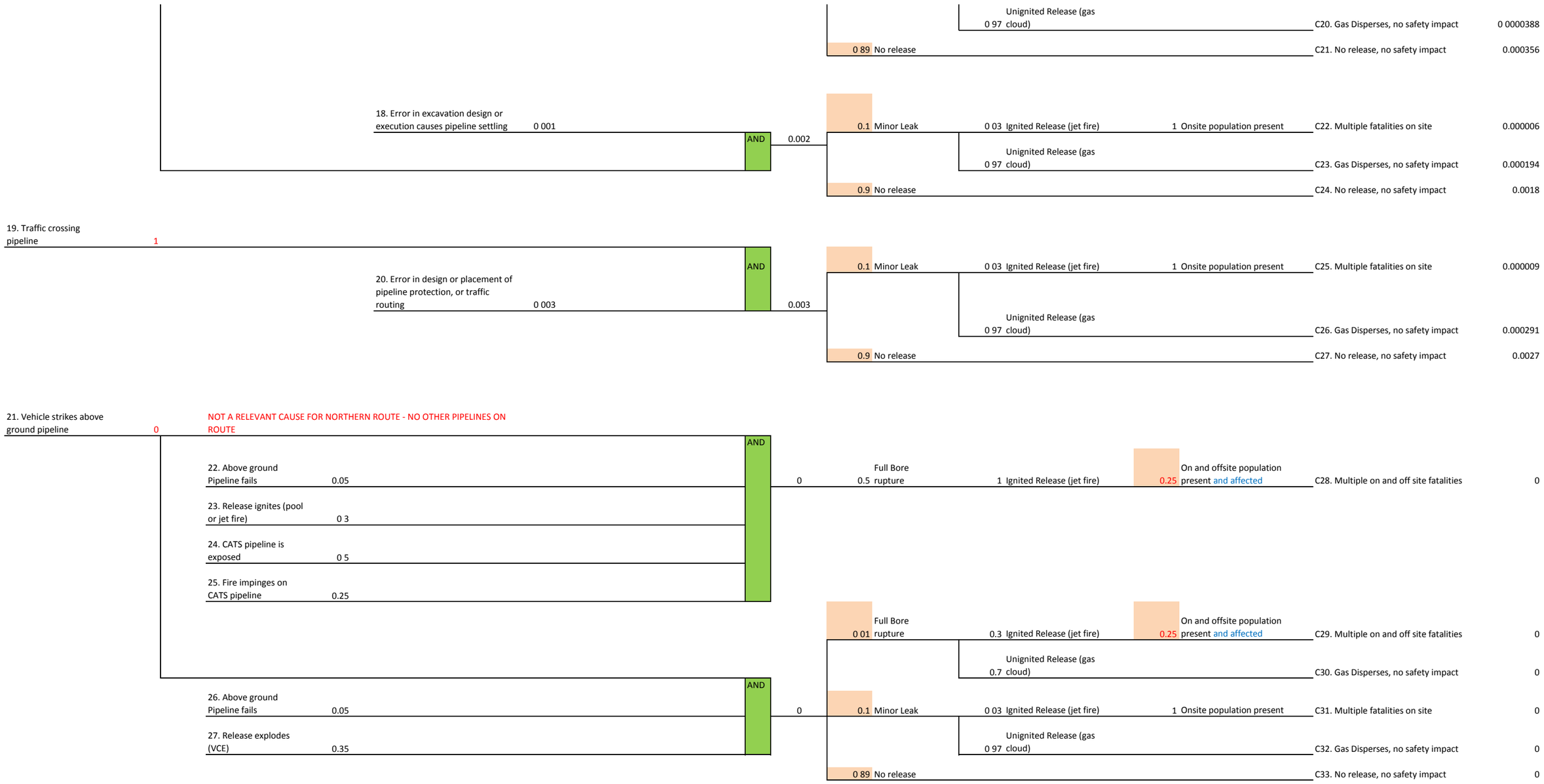
Total Event Frequencies

Multiple on and off site fatalities	**0.0000054**
Multiple fatalities on site	**0.000074**
Gas released but disperses safely	**0.00245**
Pipe impacted, but no release	**0.01683**

FAULT TREE FOR RUPTURE AND FIRE FROM CATS 36" PIPELINE AS A RESULT OF YORK POTASH CONVEYOR CONSTRUCTION ACTIVITY

CORRECTED NORTHERN ROUTE CONSTRUCTION PHASE

Activity	Freq	Event	Prob	Error	Prob		Freq of pipeline impacts	A. Rupture Prob	A. Rupture Type	B. Ignition Prob	B. Ignition Type	C. Population Prob	C. Population Description	Outcome	Freq
1. Piling (and associated excavation) adjacent to pipeline	30							0 05	Full Bore rupture	0.3	Ignited Release (jet fire)	0.25	On and offsite population present and affected	C1. Multiple on and off site fatalities	0 000016875
				2. Error in pipeline position. Excavation and subsequent piling on top of pipeline	0.0001					0.7	Unignited Release (gas cloud)			C2. Gas Disperses, no safety impact	0 0001575
				3. Poor MoC if piling or excavation location moved	0.00005	OR 0.00015	AND 0.0045	0.5	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C3. Multiple fatalities on site	0 0000675
										0 97	Unignited Release (gas cloud)			C4. Gas Disperses, no safety impact	0 0021825
		4. Excessive vibration	0 001					0.45	No release					C5. No release, no safety impact	0.002025
		5. Piling rig collapse	0.0001	OR 0.0011		AND									
							0.033	0.1	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C6. Multiple fatalities on site	0.000099
										0 97	Unignited Release (gas cloud)			C7. Gas Disperses, no safety impact	0.003201
								0.9	No release					C8. No release, no safety impact	0.0297
6. Lifting adjacent to pipeline	49							0 01	Full Bore rupture	0.3	Ignited Release (jet fire)	0.25	On and offsite population present and affected	C9. Multiple on and off site fatalities	3.68235E-06
				7. Error in crane / pipeline position (crane on top of pipe)	0.0001					0.7	Unignited Release (gas cloud)			C10. Gas Disperses, no safety impact	3.43686E-05
		8. Crane foundations failure	0.001			AND 2E-07	AND 0.0049098	0.1	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C11. Multiple fatalities on site	1.47294E-05
		9. Crane outrigger punchthrough	0.001	OR 0.002		OR 0 0001				0 97	Unignited Release (gas cloud)			C12. Gas Disperses, no safety impact	0 000476251
		11. Dropped Load (pipeline exposed)	0.00005	OR				0 89	No release					C13. No release, no safety impact	0 004369722
		12. Crane collapse (pipeline exposed)	0.00005	0.0001		0 000001									
		Exposed Pipeline protection fails	0.01	AND											
		13. Dropped Load (pipeline buried)	0 00005												
		14. Crane collapse (pipeline buried)	0 00005	OR 0.0001			AND 0.0049	0.1	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C14. Multiple fatalities on site	0 0000147
										0 97	Unignited Release (gas cloud)			C15. Gas Disperses, no safety impact	0 0004753
								0.9	No release					C16. No release, no safety impact	0 00441
15. Excavation to uncover pipeline	2							0 01	Full Bore rupture	0.3	Ignited Release (jet fire)	0.25	On and offsite population present and affected	C17. Multiple on and off site fatalities	0 0000003
				16. Error in operating excavation machinery (dig too deep)	0.0001					0.7	Unignited Release (gas cloud)			C18. Gas Disperses, no safety impact	0 0000028
				17. Error in backfilling operation causes impact	0.0001	OR 0 0002	AND 0.0004	0.1	Minor Leak	0 03	Ignited Release (jet fire)	1	Onsite population present	C19. Multiple fatalities on site	0 0000012



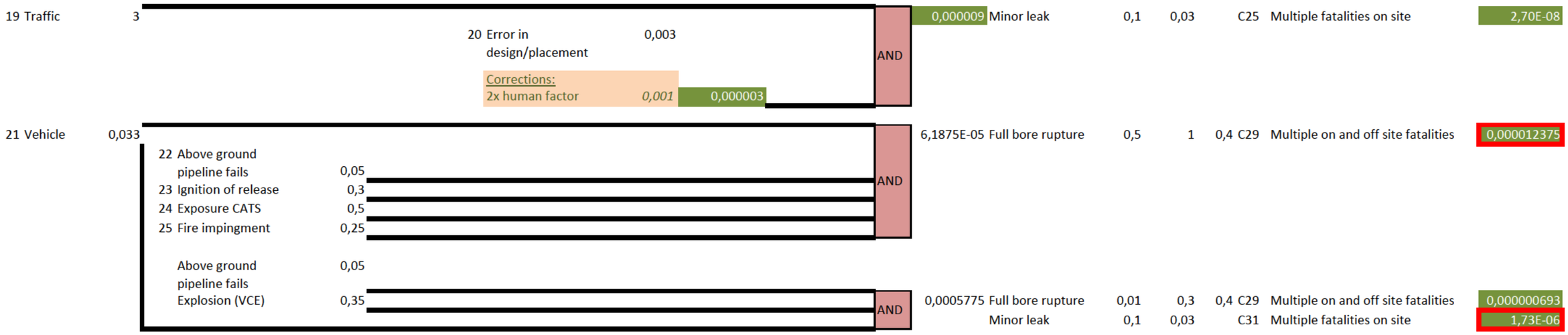
Total Event Frequencies

Multiple on and off site fatalities	**0.000021**
Multiple fatalities on site	**0.00021**
Gas released but disperses safely	**0.00705**
Pipe impacted, but no release	**0.04536**

Annex C - Fault Tree produced by RHDHV

Southern route

Activity	Freq.	Event	Probability	Corrected Pr.	Error	Probability	Corrected Pr.			Ignition	Pop.	Outcome		Frequency
1 Piling	120	2 Pipeline position	0,001					0,000024	Full bore rupture	0,05	0,3	0,4 C1	Multiple on and off site fatalities	0,000000144
		Corrections:							Minor leak	0,5	0,03	C3	Multiple fatalities on site	3,60E-07
		Factor 10	*0,1*											
		2x human factor	*0,001*	0,0000001	OR	0,0000002		AND						
		3 Poor Moc	0,0001											
		Corrections:												
		2x human factor	*0,001*	0,0000001										
		4 Vibration	0,001											
		Corrections												
		2x human factor	*0,001*	0,000001	OR	0,000002		AND	0,00024	Minor leak	0,1	0,03	C6	Multiple fatalities on site	7,20E-07
		5 Piling rig collapse	0,0001											
		Corrections												
		Protection fails	*0,01*	0,000001										
6 Lifting	180	7 Crane/pipeline position	0,001					0,00018	Full bore rupture	0,01	0,3	0,4 C9	Multiple on and off site fatalities	0,000000216
		Corrections:							Minor leak	0,1	0,03	C11	Multiple fatalities on site	5,40E-07
		Factor 10	*0,1*											
		2x human factor	*0,001*	0,0000001	AND	2E-13	NOT RELEVANT	AND						
		8 Crane foundations failure	0,001											
		Corrections												
		2x human factor	*0,001*	0,000001	OR	0,000002								
		9 Crane outrigger punchthrough	0,001											
		Corrections												
		2x human factor	*0,001*	0,000001										
		10 Dropped load	0,00005		OR	0,0001								
		11 Crane Collapse	0,00005											
		Protection fails	0,01		AND		0,000001							
		12 Dropped load	0,00005		OR	0,0001	0,000001		0,00018	Minor leak	0,1	0,03	C14	Multiple fatalities on site	5,40E-07
		13 Crane collapse	0,00005											
		Corrections			AND									
		Protection fails	*0,01*											
15 Excavation	7	16 Error in operating	0,001											
		Corrections:												
		2x human factor	*0,001*	0,000001	OR	0,000002		AND	0,000014	Full bore rupture	0,01	0,3	0,4 C17	Multiple on and off site fatalities	1,68E-08
		17 Error in backfilling	0,001							Minor leak	0,1	0,03	C19	Multiple fatalities on site	4,20E-08
		Corrections:												
		2x human factor	*0,001*	0,000001										
		18 Error in excavation design/ pipeline settling	0,001											
		Corrections:												
		2x human factor	*0,001*	0,000001				AND	0,000007	Minor leak	0,1	0,03	C22	Multiple fatalities on site	2,10E-08


19 Traffic
3
20 Error in design/placement
0,003
Corrections:
2x human factor
0,001
0,000003
AND
0,000009
Minor leak
0,1
0,03
C25
Multiple fatalities on site
2,70E-08
21 Vehicle
0,033
22 Above ground pipeline fails
0,05
23 Ignition of release
0,3
24 Exposure CATS
0,5
25 Fire impingment
0,25
AND
6,1875E-05
Full bore rupture
0,5
1
0,4
C29
Multiple on and off site fatalities
0,000012375
Above ground pipeline fails Explosion (VCE)
0,05
0,35
AND
0,0005775
Full bore rupture
0,01
0,3
0,4
C29
Multiple on and off site fatalities
0,000000693
Minor leak
0,1
0,03
C31
Multiple fatalities on site
1,73E-06

Northern route

Activity	Freq.	Event	Probability	Corrected Pr.	Error	Probability	Corrected Pr.			Ignition	Pop.	Outcome		Frequency
1 Piling	9	2 Pipeline position	0,0001					AND	0,0000018	Full bore rupture	0,05	0,3	0,25 C1	Multiple on and off site fatalities	6,75E-09
		Corrections:								Minor leak	0,5	0,03	C3	Multiple fatalities on site	2,70E-08
		~~Factor 10~~	*1*												
		2x human factor	*0,001*	0,0000001											
		3 Poor Moc	0,0001		OR		0,0000002								
		Corrections:													
		2x human factor	*0,001*	0,0000001											
		4 Vibration	0,001												
		Corrections													
		2x human factor	*0,001*	0,000001			0,000002								
		5 Piling rig collapse	0,0001		OR			AND	0,000018	Minor leak	0,1	0,03	C6	Multiple fatalities on site	5,40E-08
		Corrections													
		Protection fails	*0,01*	0,000001											
6 Lifting	14	7 Crane/pipeline position	0,0001						0,000014	Full bore rupture	0,01	0,3	0,25 C9	Multiple on and off site fatalities	1,05E-08
		Corrections:								Minor leak	0,1	0,03	C11	Multiple fatalities on site	4,20E-08
		~~Factor 10~~	*1*												
		2x human factor	*0,001*	0,0000001		2E-13									
		8 Crane foundations failure	0,001			NOT RELEVANT		AND							
		Corrections													
		2x human factor	*0,001*	0,000001			0,000002								
		9 Crane outrigger punchthrough	0,001		OR										
		Corrections													
		2x human factor	*0,001*	0,000001											
		10 Dropped load	0,00005		OR	0,0001									
		11 Crane Collapse	0,00005												
		Protection fails	0,01		AND		0,000001								
		12 Dropped load	0,00005		OR	0,0001	0,000001								
		13 Crane collapse	0,00005												
		Corrections			AND										
		Protection fails	*0,01*												
								AND	0,000014	Minor leak	0,1	0,03	C6	Multiple fatalities on site	4,20E-08
15 Excavation	2	16 Error in operating	0,001						0,000004	Full bore rupture	0,01	0,3	0,25 C17	Multiple on and off site fatalities	0,000000003
		Corrections:								Minor leak	0,1	0,03	C19	Multiple fatalities on site	1,20E-08
		2x human factor	*0,001*	0,000001			0,000002								
		17 Error in backfilling	0,001		OR										
		Corrections:													
		2x human factor	*0,001*	0,000001											
		18 Error in excavation design/ pipeline settling	0,001												
		Corrections:													
		2x human factor	*0,001*	0,000001				AND	0,000002	Minor leak	0,1	0,03	C22	Multiple fatalities on site	6,00E-09
19 Traffic	1	20 Error in design/placement	0,003						0,000003	Minor leak	0,1	0,03	C25	Multiple fatalities on site	9,00E-09
		Corrections:													
		2x human factor	*0,001*	0,000003				AND							

Northern route, corrected

Activity	Freq.	Event	Probability	Corrected Pr.	Error	Probability	Corrected Pr.			Ignition	Pop.	Outcome		Frequency
1 Piling	30	2 Pipeline position	0,0001					0,000006	Full bore rupture	0,05	0,3	0,25 C1	Multiple on and off site fatalities	2,25E-08
		Corrections:							Minor leak	0,5	0,03	C3	Multiple fatalities on site	9,00E-08
		~~Factor 10~~	*1*											
		2x human factor	*0,001*			0,0000001	0,0000002							
		3 Poor Moc	0,0001											
		Corrections:												
		2x human factor	*0,001*			0,0000001								
		4 Vibration	0,001											
		Corrections												
		2x human factor	*0,001*	0,000001		0,000002		0,00006	Minor leak	0,1	0,03	C6	Multiple fatalities on site	1,80E-07
		5 Piling rig collapse	0,0001											
		Corrections												
		Protection fails	*0,01*	0,000001										
6 Lifting	45	7 Crane/pipeline position	0,0001					0,000045	Full bore rupture	0,01	0,3	0,25 C9	Multiple on and off site fatalities	3,375E-08
		Corrections:							Minor leak	0,1	0,03	C11	Multiple fatalities on site	1,35E-07
		~~Factor 10~~	*1*											
		2x human factor	*0,001*			0,0000001	2E-13							
		NOT RELEVANT												
		8 Crane foundations failure	0,001											
		Corrections												
		2x human factor	*0,001*	0,000001		0,000002								
		9 Crane outrigger punchthrough	0,001											
		Corrections												
		2x human factor	*0,001*	0,000001										
		10 Dropped load	0,00005			0,0001								
		11 Crane Collapse	0,00005											
		Protection fails	0,01			0,000001								
		12 Dropped load	0,00005			0,0001	0,000001	0,000045	Minor leak	0,1	0,03	C6	Multiple fatalities on site	1,35E-07
		13 Crane collapse	0,00005											
		Corrections												
		Protection fails	*0,01*											
15 Excavation	2	16 Error in operating	0,001					0,000004	Full bore rupture	0,01	0,3	0,25 C17	Multiple on and off site fatalities	0,000000003
		Corrections:							Minor leak	0,1	0,03	C19	Multiple fatalities on site	1,20E-08
		2x human factor	*0,001*			0,000001	0,000002							
		17 Error in backfilling	0,001											
		Corrections:												
		2x human factor	*0,001*			0,000001								
		18 Error in excavation design/ pipeline settling	0,001											
		Corrections:												
		2x human factor	*0,001*	0,000001				0,000002	Minor leak	0,1	0,03	C22	Multiple fatalities on site	6,00E-09
19 Traffic	1	20 Error in design/placement	0,003					0,000003	Minor leak	0,1	0,03	C25	Multiple fatalities on site	9,00E-09
		Corrections:												
		2x human factor	*0,001*	0,000003										

Annex D - Detailed comments on BPs Fault Tree

Detailed comments on BP's Fault tree analysis

Introduction

This Annex provides our detailed comments on BP's Fault tree analysis, and should be read in conjunction with their tree. It uses their reference numbers.

BP event reference	RHDHV comment
2 Pipeline position	a) The enhanced factor of 10 on human error for the Southern conveyor due to the repetitive nature is not justified. See main report. b) Because of the proposed mitigation measures, 2 human errors (in the setting out) are required. See main report for details
3 Management of change	a) Because of the proposed mitigation measures, 2 human errors are required. b) We do not understand why the probability is halved for the Northern conveyor.
4 Vibration	The probability does not take into account the proposed mitigation measures, which include: - Intention to use bored or CFA piling which will minimize v bration. - Assessment of expected vibration (maximum 75 mm/s). - Level > 50 mm/s: continuous monitoring of v bration. - Random vibration monitoring at an early stage of the work. - Assessment of the effect of any v bration in case of specific ground conditions: maximum allowable peak particle velocity values to be agreed with asset owners. - Use of other piling and/or excavation methods. - Monitoring has not been taken into account.
5 Piling rig collapse	Protection of the pipeline will be provided. This protection has to fail, for which a probability of 1% is allocated.
6 Lifting	For the northern conveyor route 9 piling locations (of 18) are close enough to be considered. However, all 18 piling locations have been considered. For the corrected northern route 30 piling locations (of 38) are relevant. Only 15 conveyer sections are relevant but 19 have been considered
7 Crane pipeline position	a) The enhanced factor of 10 on human error for the Southern conveyor due to the repetitive nature is not justified in our view. b) Because of the proposed mitigation measures, 2 human errors are required.
8 Crane foundation failure	Because of the proposed mitigation measures, 2 human errors (in the setting out) are required
9 Crane outrigger punch through	Because of the proposed mitigation measures, 2 human errors (in the setting out) are required
13 Crane collapse	Protection of the pipeline will be provided. This protection has to fail, for which we consider a probability of 1%.
16 to 18 Excavation	Because of the proposed mitigation measures, 2 human errors are required for all these.
20 Traffic crossing	Because of the proposed mitigation measures, 2 human errors (in the setting out) are required
21 Vehicle strikes above ground pipeline	The frequency of a traffic incident is 1 per 30 years. This is based on one occasion with above ground product lines. This amount of data is very limited and we suspect that this is too high. There are significant uncertainties with regard to the number of cross overs and associated number/severity of incidents. For this reason it is possible the frequency of traffic incidents is an over-estimation. There was no release during that one incident. In the fault/event tree the probability of a full bore rupture has been taken as 0.5 with a certain ignition. As the data is very limited and an over-estimation is possible.

APPENDIX 2

BP CATS DEED OF GRANT[1]

[1] Although the Deed of Grant is not dated, it is effective; having been formally exchanged on 4 October 1991

PCP 622

95

Chemicals & Polymers

Alan D Frew
Secretary

We hereby certify
this to be a true copy
of the original

[redacted]

FIELD FISHER WATERHOUSE
41 VINE STREET
LONDON EC3N 2AA

ICI Chemicals & Polymers Limited
PO Box 13 The Heath
Runcorn Cheshire WA7 4QF
Telephone (0928) 513010
Telex 629655 ICIMOH G
Fax (0928) 576675

Amoco (U.K) Exploration Company
Amoco House
West Gate,
London W5 1XL

23rd September 1991

Dear Sirs,

Proposed 36" C.A.T.S. Gas Pipeline
("the Pipeline")

We are writing to confirm the agreement we have reached in regard to the above, as follows:-

1. We will grant to you a Deed of Grant ("the Deed") in respect of the Pipeline. Subject to the provisions of this letter, the Deed will be in the form of the draft Deed annexed to this letter ("the draft Deed")

2. The Deed will be completed as soon as practicable after construction of the Pipeline has been completed

3(1) The plan ("the Plan") numbered 2 attached to the draft Deed shows by the line coloured red the intended route of the Pipeline but the precise route of the Pipeline and construction method shall be subject to our prior written approval but such approval will not be unreasonably withheld or delayed and the plan to be attached to the Deed shall be one which shows such precise route. You will promptly provide us with such details as we may reasonably request of the design of the Pipeline and confer with us in regard thereto as reasonably requisite.

(2) In carrying out the construction works you will comply with the provisions of the Schedule attached hereto

4. Subject to your:-

(i) obtaining any necessary authorisation under the Pipe-lines Act, 1962

continued/.....

(ii) obtaining any necessary planning permission(s) and other statutory consents

(iii) giving us prior written notice of the initial intended entry on to our land, as follows:-

(a) in the case of the initial entry for survey purposes or other purposes not involving excavation on our land - five working days' notice; and

(b) in the case of the initial entry for purposes involving excavation - ten working days' notice

(iv) obtaining and complying with in all respects a permit to work in accordance with the provisions of the draft Deed; and

(vi) complying with the provisions of the foregoing paragraph 3 of this letter;

we consent to the commencement and continued undertaking of works for the construction of the Pipeline on our land.

5. Following entry onto our land for the purposes of construction both we and you will have the like rights and obligations as if the Deed had been granted;

6. The consideration of ONE HUNDRED AND THIRTY THOUSAND POUNDS (£130,000.00) referred to in the draft Deed will be paid to us when entry is taken onto our land for construction purposes or on counter-signature hereof (if later) ;

7. The consent hereby given shall cease to be of effect if the Pipeline has not been constructed or is not under construction by the 31st December 1992 whereupon the terms of this consent shall cease to have effect (but without prejudice to any party's rights in respect of any antecedent breach of covenant and without prejudice to your obligations in respect of reinstatement contained in the draft Deed);

8. Should there be any dispute as to any rights or obligations arising out of this letter the same may be referred to a single suitably experienced arbitrator appointed in default of agreement by the President for the time being of the Law Society London and such arbitration shall be conducted in accordance with the Arbitration Acts 1950 - 1979 and the costs of the arbitrator shall be within his award.

9. You will be responsible for our reasonable Surveyor's fees and legal costs in connection with the preparation and negotiation of this letter.

Please counter-sign the copy of this letter which has been furnished to you to indicate your agreement to the terms of this letter.

Yours faithfully,

for and on behalf of
ICI CHEMICALS & POLYMERS LIMITED

We agree the above terms

[redacted]....

for and on behalf of
AMOCO (U.K) EXPLORATION COMPANY

4th October 1991

DMC

DATED 199

ICI CHEMICALS & POLYMERS LIMITED

- to -

AMOCO (U.K.) EXPLORATION COMPANY

DEED OF GRANT

relating to a pipe-line laid in land
at Bran Sands near Wilton, Cleveland

Field Fisher Waterhouse
41 Vine Street
London
EC3N 2AA

SCHEDULE

1. Where the Pipeline crosses existing access roads (at the points lettered C and G on the Plan) these access roads will be kept open at all times (or suitable temporary diversions shall be made) and our use thereof will not be restricted in any way

2. Between the points lettered B and H in the Plan the Pipeline will be laid beneath the existing gravel access track and will be placed at such depth (or be so protected) as to permit our continued use of that track for the purposes of access to our adjoining land for all purposes including the construction in our adjoining land of new overground pipelines and the use thereon of construction and other vehicles up to the same maximum weight as that applicable to vehicles permitted to use the public highway

3. Where the Pipeline passes beneath any parts of or apparatus associated with the pipelines laid in our pipe corridor adjoining the Easement Strip (as defined in the draft Deed) you will ensure that such pipelines are not caused to subside and are not otherwise damaged by the carrying out of your works and you will provide all temporary and permanent means of support and underpinning which may be needed for this purpose

4. Between the points lettered F & G on the Plan (where the Pipeline crosses the existing surface water drain into Dabholme Gut) you will (where any backfilling work is needed in order to support the Pipeline) culvert such drain to our reasonable satisfaction to ensure that the flow of water into Dabholme Gut is not impeded

5. A working compound (for identification shown coloured pink on Plan A attached hereto) shall be made available during the construction phase plus such working space (in addition to the Easement Strip) as may be agreed on site between the parties' respective engineers.

Work, Area
ICI

CHEMICAL DEPOT

FENCE
PIPE RACK
EXISTING TUNNEL BUILDING
I.C.I. LAND
EXISTING PIPE TUNNEL
FENCE
EFFLUENT LINE
SITE AREA
CHEMICAL WORKS
SEAL SANDS ROAD
PIPE RACK
PIPE RACK
TEES STORAGE LAND
RIVER TEES
CONTINUED BELOW

BILLINGHAM (WEST SIDE)
SCALE 1:2500

BILLINGHAM SIDE
EXISTING TUNNEL
WILTON SIDE
LAGOON
NEW TUNNEL
SEWER
RIVER TEES

GENERAL LOCATION PLAN
SCALE 1:10000

SITE AREA
OFFICES FOR TUNNEL ONLY
LAGOON
PIPE RACK
PIPE BRIDGES
PORTACABIN
EXISTING TUNNEL BUILDING
ACCESS ROAD
TEMPORARY STEELWORK OVERBRIDGE TO PROTECT I.C.I PIPERACK
DABHOLM GUT
ELECTRICITY CABLES
EFFLUENT LINE
PIPE RACK
CULVERT
STREAM
ROAD
NORTHUMBRIAN WATER AUTHORITY PUMP HOUSE
OVERHEAD POWER LINE
RT AUTHORITY OAR TOWER
TRACK
FENCE
RIVER TEES
35 metres x 50 metres WORKING AREA

I.C.I. WILTON (EAST SIDE)
SCALE 1:2500

DATE	REVISION	BY	CHKD	BY	CHKD	LEAD	PROJ	APPD AMOCO
17 5 91	ISSUED A.F.D.	JLP						
3-91	ISSUED FOR BID PURPOSES ONLY	BS.	KB	—				

BRV - CAD | BRV - ENGINEERING

DRAWING No. | SUBJECT

NOTES

Plan A

DO REF No	
DRAWN	I G. HOLLAND
DATE	05-03-91
SCALE	AS SHOWN
CHECKED	MRC
APPROV'D	MCK
	BRV / AMOCO

Howard Humphreys & Partners Ltd.

CENTRAL GRABEN DEVELOPMENT/CATS PROJECT

RIVER TEES TUNNEL

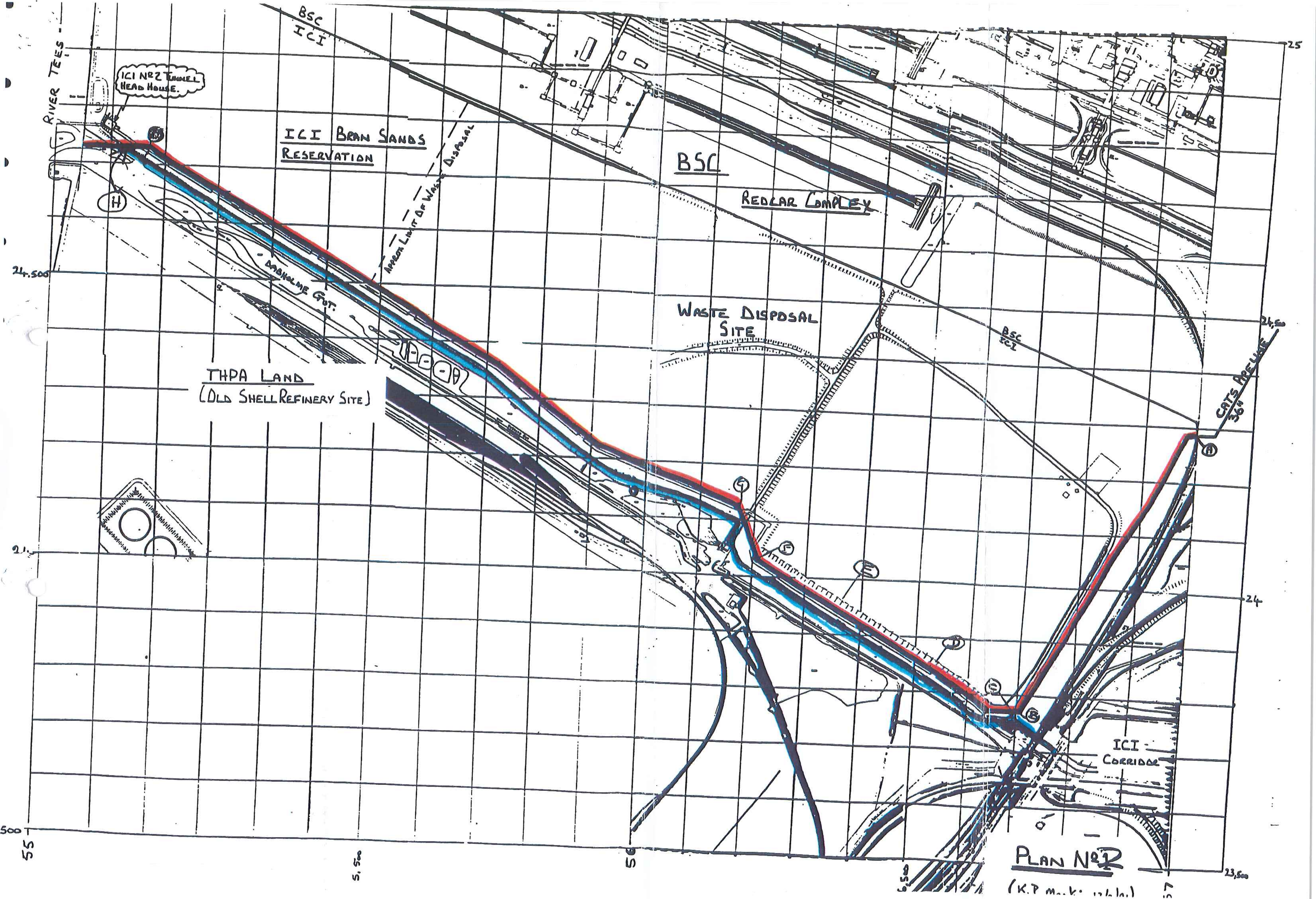
SITE LOCATION, ACCESS, AREAS AND EXISTING SERVICES

PROJECT No. AC-01006

Brown & Root Vickers

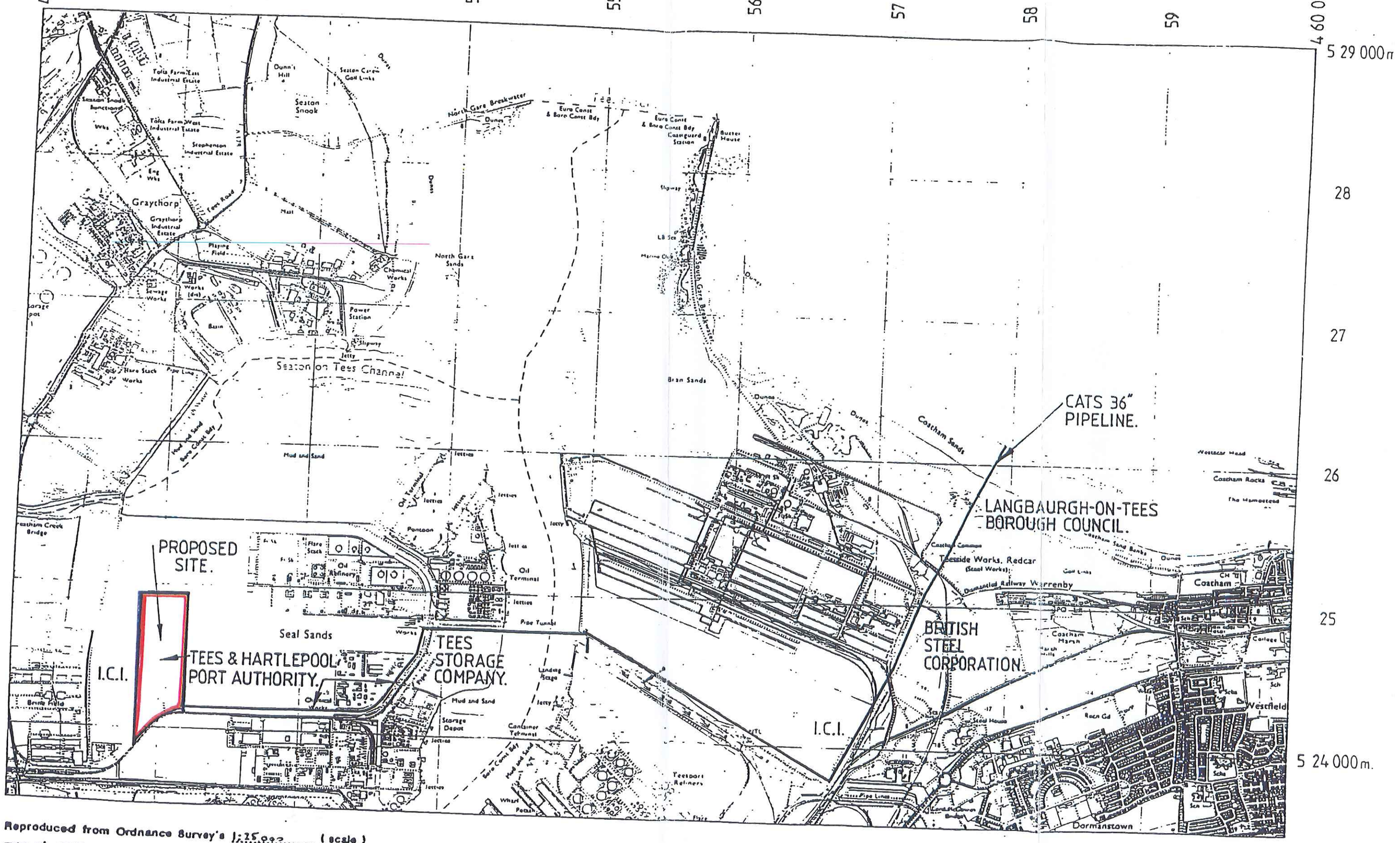
DRAWING No. | SHEET No. | REV

AMOCO UK EXPLORATION COMPANY



BSC
ICI
RIVER TEES
ICI No2 TUNNEL HEAD HOUSE.
ICI BRAN SANDS RESERVATION
APPROX LIMIT OF WASTE DISPOSAL
BSC
REDCAR COMPLEX
WASTE DISPOSAL SITE
THPA LAND
(OLD SHELL REFINERY SITE)
BSC
ICI
CATS PIPELINE
ICI CORRIDOR
H
G
F
E
D
C
B
A
H
25
24,500
24
23,500
500
55
5,500
56
57
PLAN No2

TEESIDE AREA – ONSHORE SITE MAP.
PROBABLE ONSHORE PIPELINE ROUTE.



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Plan N° 1.

FHC181.40

THIS DEED is made the day of One thousand nine hundred and ninety BETWEEN ICI CHEMICALS & POLYMERS LIMITED whose registered office is at The Heath Runcorn Cheshire WA7 4QF (hereinafter called "the Owner") of the one part and AMOCO (U.K.) EXPLORATION COMPANY of Amoco House West Gate London W5 1XL (hereinafter called "Amoco") of the other part

WHEREAS:-

(1) Amoco has been granted by the Secretary of State for Energy a Pipe-line Construction Authorisation in accordance with Section 1 of the Pipe-lines Act, 1962 for the construction of a pipeline between Coatham Sands Low Water Mark and Seal Sands Teesmouth Teesside in the County of Cleveland

(2) The route of the said pipe-line crosses the land described in the First Schedule hereto which is now vested in the Owner for a legal estate in fee simple in possession subject as hereinafter appears but otherwise free from incumbrances

(3) Amoco desires to acquire the necessary easements and rights to enable part of the said pipe-line to be laid used and maintained in the said land in such manner as to cause the least possible damage to the said land or annoyance or inconvenience to the owner thereof and for this purpose the Owner has agreed to grant to Amoco the easements and rights hereinafter contained upon the terms hereinafter appearing

NOW THIS DEED WITNESSETH as follows:-

1. IN this Deed and the Schedules hereto unless the context otherwise requires:-

(1) The singular shall include the plural and the masculine shall include the feminine and the neuter

(2) The following expressions are used with the following meanings that is to say:-

(a) "Plan 1" and "Plan 2" mean the plans annexed hereto and respectively so numbered;

(b) "the Authorised Pipe-line" means the pipe-line constructed or to be constructed in accordance with the said Pipe-line Construction Authorisation including such apparatus and works as are specified in Section 65(2) of the Pipe-lines Act, 1962 and all wrapping and protective materials;

(c) "the Terminal" means gas reception terminal of Amoco at Seal Sands aforesaid shown for the purpose of identification only edged red on Plan 1 ;

(d) "the Grantor's Land" means the land of the Owner at or near Bran Sands and Wilton in the County of Cleveland including in particular but without prejudice to the generality of the foregoing the land comprised in the Deeds specified in the Fourth Schedule hereto ;

(e) "the Grantor" means the Owner and its successors in title the owners for the time being of the Grantor's Land;

(f) "the Grantee" means Amoco and its successors and assigns owners from time to time of the Terminal;

(g) "the Easement Strip" means such part of the Grantor's Land as comprises a strip of land 5 metres wide in which the pipe shall have been centrally situated except that :-

(i) between the points lettered 'A' and 'B' on Plan 2 the Easement Strip shall be a strip of land 10 metres wide in which the pipe shall have been centrally situated ; and

(ii) at each of the two points lettered 'D' and 'E' on Plan 2 the width of the Easement Strip shall be 3 metres where in each of such two cases for a distance of approximately 35 metres the pipe runs parallel with an expansion loop on an existing pipe-line of the Owner ;

(h) "the Specified Rights" means the easements and rights specified in the First Schedule hereto;

(i) "the pipe-line" means such part of the Authorised Pipe-line as has been or is to be laid through under or over the Grantor's Land;

(j) "the Development Provisions" means the covenants agreements rights and provisions specified in the Second Schedule hereto;

(k) "the Appropriate Standard" means a standard of care conduct and workmanship consistent with contemporary good practice in the petrochemical industry;

(l) "the Planning Acts" means any and all of the Town and Country Planning Act 1971 the Town and Country Planning Act 1990 the Planning (Listed Buildings and Conservation Areas) Act 1990 the Planning (Hazardous Substances) Act 1990 and the Planning (Consequential Provisions) Act 1990

2. IN consideration of the sum of ONE HUNDRED and THIRTY THOUSAND POUNDS (£130,000.00) on or before the execution hereof paid by Amoco to the Owner (the receipt whereof the Owner hereby acknowledges) the Owner HEREBY GRANTS AND

DEMISES unto the Grantee ALL AND SINGULAR the Specified Rights TO HOLD the same unto the Grantee as easements for a term of 99 years from 1st March 1991 TO THE INTENT that the Specified Rights may be annexed and appurtenant to the whole and each and every part of the Undertaking of Amoco consisting of the Terminal and the rights acquired by Amoco or its successors or assigns for the purposes of the Authorised Pipe-line YIELDING AND PAYING therefor throughout the term hereby granted the yearly rent of one pound (if demanded) payable on 1st January in every year (and inclusive of any applicable Value Added Tax) AND SO THAT the aforesaid grant and demise shall be subject so far as thereby affected to the provisions of the Deeds and documents listed in the Fourth Schedule hereto and of the documents therein referred to but with the benefit of such of the provisions of the said Deeds and documents as are capable of protecting the Grantee as lessee of the Specified Rights

3. AMOCO HEREBY COVENANTS with the Grantor that the Grantee will:-

(1) At all times take all reasonable and proper precautions to ensure that in the exercise of the Specified Rights as little damage as possible is caused to the Grantor's Land and any structures thereon or drains thereunder and make good or pay compensation to the Grantor or the occupier of the said land for any loss damage or injury suffered by them or either of them by reason of the exercise of the Specified Rights or any of them

(2) With all practicable speed reinstate and put any part of the Grantor's Land opened or broken up in the exercise of the Specified Rights into as good a condition in all respects so far as is practicable as the same was in prior to such opening or breaking up as aforesaid and make compensation to the Grantor or the occupier of the said land for any loss or damage suffered by them or either of them by reason of any such exercise as aforesaid

(3) Keep the pipe-line in good repair and condition in accordance with the Appropriate Standard and indemnify and keep indemnified the Grantor and its tenants or licensees or other the occupier or occupiers for the time being of the land of the Grantor from and against all claims and liabilities whatsoever in respect of the exercise of the Specified Rights BUT SO THAT the financial liability of the Grantor under such indemnity shall not exceed the Maximum Sum (as defined in Clause 5(8) hereof) for any one occurrence and shall exclude any claims and liabilities occasioned by the neglect or default of the Grantor or its tenants or licensees or other such occupier or occupiers as aforesaid or their respective servants or workmen or others authorised by them Provided that any person or body claiming indemnity hereunder shall give notice as soon as reasonably possible to the Grantee of every claim or demand made against it which it considers is covered by the indemnity hereinbefore contained and shall not make any admission of liability to the person or body making the claim or demand or settle or compromise any such claim or demand without the consent in writing of the Grantee and shall (if so requested by the Grantee) authorise the Grantee to negotiate a settlement of any such claim or demand and to conduct on its behalf any litigation which may arise in respect of any such claim or demand upon giving to it such reasonable indemnity as it may require in relation to the costs and expenses of the litigation

(4) Perform and observe the Development Provisions so far as the same fall to be performed and observed by the Grantee

(5) Pay discharge and indemnify the Grantor against all rates and taxes payable in respect of the pipe-line

(6) Comply with the terms and conditions set out in the Third Schedule hereto

4. SUBJECT to the provisions of Clauses 5(3) 5(4) and 5(7) hereof the Owner HEREBY COVENANTS with the Grantee TO THE

INTENT that the benefit of this covenant may be annexed to and run with the whole and each and every part of the aforesaid Undertaking of the Grantee and TO THE INTENT that the burden of each of these covenants may run with and bind the Easement Strip and every part thereof that the Grantor will comply with the following obligations:-

(1) That the Grantee observing the covenants on its part and the conditions hereinbefore contained may peaceably enjoy the Specified Rights without any interruption from the Grantor or any person lawfully claiming through under or in trust for the Grantor and that the Grantor shall not do or cause or permit to be done on the Grantor's Land anything likely or calculated to cause damage or injury to the pipe-line and will take all reasonable precautions to prevent such damage or injury

(2) Not to erect construct or place or suffer to be erected constructed or placed any building or structure or permanent apparatus in through upon or over the Easement Strip or carry out or suffer to be carried out any excavation or plant or suffer to be planted any trees on the Easement Strip without the previous consent in writing of the Grantee (such consent not to be unreasonably withheld or delayed) and where appropriate of the Secretary of State for Energy under Section 27 of the Pipe-lines Act, 1962

(3) Not materially to raise or lower or suffer to be raised or lowered the existing level of the surface of the Easement Strip nor cause or permit to be made any material alteration to or any deposit of anything upon the Easement Strip so as to interfere with or obstruct the access thereto or to the pipe-line by the Grantee or so as to lessen or interfere with the support afforded to the pipe-line by the surrounding soil including minerals or so as to reduce the depth of soil over the pipe-line without the previous consent in writing of the Grantee (such consent not to be unreasonably withheld or delayed) and where appropriate of

the said Secretary of State under Section 31 of the Pipe-lines Act, 1962

(4) Not to undermine or damage or suffer to be undermined or damaged the pipe-line or do or suffer to be done anything which may interfere with free flow and passage through the pipe-line

(5) To perform and observe the Development Provisions so far as the same fall to be performed and observed by the Grantor

5. IT IS HEREBY AGREED AND DECLARED as follows:-

(1) That at all times the pipe-line shall be and remain in the ownership of the Grantee

(2) That if at any time or times the Grantee shall desire to abandon the pipe-line or any part or parts thereof and shall give written notice of such desire to the Grantor then subject as hereinafter provided this Deed and everything herein contained shall be void and the term hereby created shall determine or (as the case may be) the provisions hereof shall cease to have effect and the term hereby created shall determine in relation to such part or parts of the pipe-line without prejudice

(a) to any claim by the Grantor or by the Grantee in respect of any antecedent breach of any covenant or condition herein contained or

(b) to the right of the Grantor to apply to the Grantee for a formal release of the Specified Rights in whole or in part (as the case may be) which release shall not be unreasonably withheld and the whole costs and expenses thereof reasonably incurred by the Grantor shall be paid by the Grantee

PROVIDED THAT if at any time or times after abandonment in manner aforesaid by the Grantee of the pipe-line or any part or parts thereof the Grantor shall desire to carry out any development of the site of the pipe-line as so abandoned or any part or parts thereof the Grantor shall supply the Grantee with full details in writing of the proposed development and use its best endeavours with the assistance if requested of the Grantee free of charge so to arrange the same as to avoid removal of the pipe-line as so abandoned or any part or parts thereof If it can nonetheless reasonably be shown that the proposed development would be prevented by the position of the pipe-line as so abandoned or any part or parts thereof the Grantor shall be entitled to require the Grantee at its expense to remove the pipe-line or such part or parts thereof as may be necessary to enable the development to be carried out PROVIDED ALSO that nothing herein contained shall release the Grantee from its obligations under Paragraph 9 of the said Third Schedule hereto or under the provisions of Sections 25 and 36 of the Pipe-lines Act, 1962

(3) That the Grantor and/or other the occupier of the Easement Strip shall have the right to provide new or improved accesses across or along the Easement Strip and to lay maintain and support pipelines sewers drains pipes cables and other services reasonably required across or along the Easement Strip subject to compliance with the following conditions , viz :-

(a) Save in cases of emergency the Grantor or such occupier shall before exercising the said right furnish plans or other appropriate details of the work to the Grantee and shall not commence the work unless and until such plans or details shall have been approved in writing by the Grantee such approval not to be unreasonably withheld or delayed Provided that if the Grantee shall not have sent to the Grantor or such occupier (as the case may

be) notice of rejection of the plans or details within one month of having received the same the Grantee shall be deemed to have approved the same in writing

(b) As a condition of signifying its approval of the said plans or details the Grantee may specify any protective works whether temporary or permanent which the Grantee requires to be carried out to ensure the safety and accessability of the Authorised Pipe-line and such protective works shall be constructed by and at the cost of the Grantee and in accordance with the Appropriate Standard save in the case where the Grantor's proposed works are not for the benefit of or are not to be used in connection with premises in the Grantor's ownership when the cost of such protective works shall be borne by the Grantor

(c) The Grantor or such occupier shall give to the Grantee fourteen days' notice in writing of the intention to commence work

(d) Such work shall be carried out in accordance with the plans or details so submitted to and approved by the Grantee and shall when commenced be carried out to the Appropriate Standard with all reasonable despatch and to the reasonable satisfaction of the Grantee (and so that the Grantee may have an observer present while such works are being undertaken)

(e) Any difference arising between the Grantee on the one hand and the Grantor or such occupier on the other hand with regard to plans or details so submitted the manner of

construction of the work or any protective works required by the Grantee shall be referred on the application of any party to arbitration by an arbitrator appointed by the President for the time being of the Institution of Civil Engineers and

(f) If the Grantor shall by reason of the provisions of this Clause 5(3) incur additional expense in carrying out in the Easement Strip any of the works contemplated by this sub-clause the Grantee shall reimburse the Grantor in respect of such reasonable additional expense

(4) The Grantor shall at all times be entitled to use or permit to be used the Easement Strip or any part or parts thereof for any lawful purpose which is not in derogation from its grant (not causing damage to the Authorised Pipeline or doing any other act or thing which is expressly prohibited by Clause 4(2) hereof or in respect of which the Grantee's consent has been rightfully refused thereunder or in breach of any condition properly imposed by the Grantee upon any consent given thereunder) connected with the use and enjoyment of the Grantor's Land including without prejudice to the generality of the foregoing the use and maintenance thereof or of part thereof as part of the access track lying between the points lettered 'B' and 'H' and shown coloured blue on the Plan and the use and maintenance thereon and thereover of the existing expansion loops forming part of the Grantor's pipe corridor adjoining or adjacent to such access track (but so that any work undertaken by or on behalf of the Grantor shall be carried out in accordance with the Appropriate Standard)

(5) The liability of the Grantee under the provisions of this Deed as to (a) indemnity against claims and liabilities in respect of the exercise of the Specified Rights and (b) the making good of or paying compensation for

loss damage or injury due to the exercise of the Specified Rights shall extend to and include respectively claims and liabilities and loss damage and injury caused by reason of (i) the negligence trespass or wilful act or default of any person or persons directly or indirectly employed by the Grantee in connection with the exercise of the Specified Rights (ii) the actions of the Grantee's contractors and their subcontractors and of all persons employed in connection with the exercise of the Specified Rights except for actions carried out expressly at the request of the Grantor or the occupier of the Easement Strip and (iii) any damage or destruction of the Authorised Pipe-line or any escape of any material therefrom where such damage destruction or escape is caused by the acts or omissions (including any malicious damage by a third party) of any person other than the Grantor or his tenants or licensees or other occupier or occupiers for the time being of the Grantor's Land or their respective servants or workmen or others authorised by them and shall also extend to and include any claims by and liabilities to and loss damage or injury suffered by the Grantee its servants agents or contractors or any other persons directly or indirectly employed by the Grantee in connection with the exercise of the Specified Rights arising wholly or in part by reason of any contamination of the Grantor's Land (but so that the Grantor shall notify the Grantee in writing of any special conditions which may from time to time apply to its own servants or agents working in the area of the Easement Strip)

(6) Nothing in this Deed or in any consent or approval granted by the Grantor under this Deed shall imply or warrant (a) that the Grantor's Land (or any part thereof) may be used in accordance with the Planning Acts or any restriction or covenant affecting the same for the purpose authorised herein or in any such consent or approval or any purpose subsequently authorised or (b) that the Grantor's Land (or any part thereof) is free from contamination or suitable for use by the Grantee for the purposes of this

Deed and all and any liability whatsoever of the Grantor to the Grantee in respect of any such restrictions covenants and contamination (if any) is hereby expressly excluded

(7) (a) Subject as hereinafter provided the provisions (in this sub-clause called "the Mining Code") substituted by Part II of and the First Second and Third Schedules to the Mines (Working Facilities and Support) Act, 1923 for Sections 78 to 85 of the Railways Clauses Consolidation Act, 1845 shall be deemed to be incorporated herein and the provisions of Clause 4 of this Deed shall take effect subject to the Mining Code

(b) In the construction of the Mining Code for the purposes of this Deed the following expressions used therein shall have the following meanings that is to say:-

"minerals" shall be deemed to include sand and gravel

"the mine owner" shall mean the Grantor

"the company" shall mean the Grantee

"the railway" "the works" and "the works of the company" shall mean the pipe-line

"the centre of the railway" shall be deemed to be the centre of the pipe-line as laid

"the rail level" shall be the level of the top of the pipe-line as laid

(c) Section 196 of the Law of Property Act, 1925 as adapted by the Recorded Delivery Service Act, 1962 shall be substituted for Section 85C of the Mining Code and Clause 6 of this Deed shall be substituted for Section 85D(3) of the Mining Code

(d) Save as provided by paragraph (b) of this sub-clause the interpretations provided by Sections 85D (1) and (2) of the Mining Code shall apply for the purposes hereof

(8) The Maximum Sum shall be the greater of One hundred million pounds (£100,000,000) or the said sum increased by a percentage equal to the percentage increase in the General Index of Retail Prices published by the Central Statistical Office or any successor Department or Ministry (or any official publication substituted therefor) between the Index for the month of July 1991 and the Index for the year (a year for this purpose being deemed to commence on 1st August and to end on the following 31st July) in which the loss is incurred calculated by reference to Clause 5(8) (ii) PROVIDED THAT:-

(i) in the event of it becoming impossible by reason of any change after the date hereof in the methods used to compile the said Index or for any other reason whatsoever to calculate the revised limit of the liability of the Grantee by reference to the said Index or if the said Index shall cease to be published the determination of an alternative method of calculating such revised limit of the Grantee's liability shall be agreed between the parties hereto and in default of agreement between the parties by a single arbitrator in accordance with the Arbitration Acts 1950 - 1979 or statutory modification or re-enactment thereof for the time being in force who shall have full power to determine on such dates as he shall deem appropriate what would have been the increase in the said Index had it continued on the basis and giving the information assumed to be available for the operation of this clause;

(ii) the said revised limit of the Grantee's liability (if any) shall be calculated on 1st August of each year by

reference to the said Index during the preceding month of July

6. ANY difference (not being one affecting the construction of this Deed) which may arise between the Grantor and the Grantee and for the determination of which this Deed does not expressly otherwise provide shall be determined in accordance with the Arbitration Acts, 1950 to 1979 or any statutory modification thereof for the time being in force by a suitably experienced single arbitrator to be agreed between them or failing such agreement to be appointed on the application of either of them by the President for the time being of The Royal Institution of Chartered Surveyors Provided Nevertheless that the Grantor and the Grantee shall be entitled to institute proceedings to restrain the other from doing anything which is contrary to the terms and conditions of this Deed

7. THE Owner HEREBY ACKNOWLEDGES the right of the Grantee to the production of the documents of title specified in the Fourth Schedule hereto and to delivery of copies thereof and HEREBY UNDERTAKES with the Grantee for the safe custody thereof

8. THIS document shall not be presumed to be delivered and shall not be or take effect as a Deed until it is dated

IN WITNESS whereof the parties hereto have caused this Deed to be executed as a Deed

THE FIRST SCHEDULE
THE SPECIFIED RIGHTS

1. A right to maintain in position any part or parts of the pipe-line already laid or constructed and a right to construct and place the pipe-line in and under the Easement

Strip as nearly as reasonably practicable along the line coloured red on Plan 2 BUT SO THAT:-

(a) between the points lettered 'B' and 'H' on the Plan the pipe-line shall be laid and maintained at such depth (being at least one metre) as will ensure that the access track between those lettered points shall be suitable for use as a vehicular access (by vehicles of a weight up to the maximum permissible for use on the public highway at the date hereof in accordance with Department of Transport Code HA) to the Grantor's adjoining land including use for construction traffic in connection with the construction of pipelines and other services media on and under the Easement Strip and the Grantor's Land in the vicinity thereof; and

(b) no above ground equipment will be constructed on the Easement Strip save for one cathodic protection test pole at a location to be first approved by the Grantor and marker posts at such intervals and in such places as shall be approved by the Grantor (such approval not to be unreasonably withheld or delayed)

2. Subject to the provisions of Paragraphs 1 2 and 7 of the said Third Schedule to this Deed a right for the officers servants and agents of the Grantee at all reasonable times and in an emergency at all times with or without contractors surveyors employees and others and with or without motor or other vehicles plant apparatus and materials to enter upon the Easement Strip for the purpose of exercising or in connection with the exercise of any of the rights granted to the Grantee by this Deed and temporarily to place on the Easement Strip any such plant apparatus and materials required to be used in connection with the purposes aforesaid

3. A right to excavate and open up so much of the Easement Strip and to carry out such works thereon as may be reasonably required for the purpose of laying constructing

maintaining adjusting altering renewing repairing testing cleansing relaying making safe protecting whether cathodically or otherwise or removing any part or parts of the Authorised Pipe-line

4. A right to alter the pipe-line or any part or parts thereof in accordance with the Development Provisions

5. A right to construct maintain and use on the Easement Strip pedestrian crossings over ditches and protective concrete slabs and culverts to facilitate inspection and maintenance of the Authorised Pipe-line PROVIDED THAT the siting design and location of any crossings slabs or culverts installed pursuant to this Paragraph 5 shall first be approved in writing by the Grantor such approval not to be unreasonably withheld or delayed

6. A right to use the pipe-line for the transmission of any hydrocarbons or mixture of hydrocarbons and other gases consisting primarily of methane which are or is in the gaseous state and all other hyrdocarbons and liquids which are contained in the gaseous state

7. Subject to the provisions of Paragraph 7 of the said Third Schedule to this Deed a right for the agents and servants of the Grantee at any time and from time to time to enter upon the Easement Strip for the purposes of walking the line of the pipe-line

8. A right to remove any trees which or the roots of which may grow in on over or under the Easement Strip

THE SECOND SCHEDULE
THE DEVELOPMENT PROVISIONS

1. In this Schedule the following expressions shall have the following meanings that is to say:-

(1) "development" shall have the meaning assigned thereto in Section 55 of the Town and Country Planning Act, 1990 except that it shall not include the carrying out of mining operations

(2) "planning permission" shall have the meaning assigned thereto by Section 366 of the Town and Country Planning Act, 1990

2. (1) If at any time or times the Grantor desires to carry out any development of the Grantor's Land and the Grantor's ability to carry out such development is or may be affected by the presence of the pipe-line in the Grantor's Land he will:-

(a) supply to the Grantee full details thereof in writing and

(b) use all reasonable endeavours with the assistance if requested of the Grantee free of charge so to arrange the development as to avoid the need for works to the Authorised Pipe-line (being works of reinforcement protection or otherwise not involving a diversion thereof) and will consult with the Grantee to this end

(2) If following such consultations:-

(a) the Grantor obtains planning permission for the development but the same is prevented by reason of the presence of the pipe-line or would be so prevented apart from other reasons which the Grantor can demonstrate to be readily surmountable otherwise than at the expense of the Grantee ; or

(b) planning permission for the development is refused by reason of the presence of the pipe-line or the planning permission is refused in part by such reason aforesaid and in part for reasons which the Grantor can

demonstrate to be readily surmountable otherwise than at the expense of the Grantee ; and

(c) in either such case the Grantor can demonstrate that the presence of the pipe-line would not prevent the development or the grant of planning permission (as the case may be) if works to the Authorised Pipe-line were carried out

the Grantor shall be entitled to give written notice to the Grantee stating that the Grantor requires the Grantee to carry out (in accordance with the Appropriate Standard) such works to the Authorised Pipe-line as may be necessary so that the presence of the pipe-line does not prevent the development or the grant of planning permissions as aforesaid (as the case may be)

3. The said works shall be carried out in accordance with a timetable which shall be agreed between the Grantor and the Grantee or failing agreement as shall be determined by an arbitrator to be appointed by the President for the time being of the Institution of Civil Engineers as being the timetable which will cause the least possible interference with the use and enjoyment by the Grantor of the Grantor's Land commensurate with the reasonable requirements of the Grantee in connection with the works to be carried out to the Authorised Pipe-line and the minimising of any interruption in the flow therethrough TO THE INTENT that so far as practicable any such works shall be carried out so as to coincide with any annual or other planned maintenance period during which the Authorised Pipe-line shall be non-operational

4. On the carrying out of works to the Authorised Pipe-line under the preceding Paragraphs of this Schedule:-

(1) the Grantee shall make reasonable compensation to the Grantor or the occupier of the Grantor's Land in respect of any loss of profit or disturbance or surface damage

resulting from the works and the Grantee shall make good any damage to the surface of the land to the reasonable satisfaction of the Grantor

(2) the Grantor's reasonable Surveyor's fees in connection with the works shall be borne by the Grantee

(3) the provisions of this Deed shall be deemed to apply mutatis mutandis to the pipe-line as altered

(4) the works shall be carried out by the Grantee with all reasonable despatch and all work in connection therewith shall be executed in accordance with the Appropriate Standard

5. Subject to the provisions of Paragraph 6 below the carrying out to the whole or any particular part of the pipe-line at the cost of the Grantee of such works as may be necessary so that the position of the pipe-line does not prevent development or the grant of planning permission shall take place once only

6 (1) Notwithstanding the provisions of the foregoing Paragraph 5 the Grantor shall be entitled at any time or times to require that works be carried out to the Authorised Pipe-line so that the presence of the pipe-line does not prevent development or the grant of planning permission if all costs and expenses relating thereto are borne by the Grantor

(2) In the case of works required under the preceding sub-paragraph the provisions of Paragraphs 1 to 4 of this Schedule shall apply thereto with the following modifications:-

(a) when supplying details of the development in accordance with Paragraph 2(1)(a) the Grantor shall state in writing that it is contemplating the requirement of works under this Paragraph 6;

(b) the Grantor shall reimburse the Grantee in respect of the cost of any assistance afforded by the Grantee under Paragraph 2(1)(b);

(c) no compensation shall be payable by the Grantee under Paragraph 4(1) and no surveyor's fees shall be payable by the Grantee under Paragraph 4(2) ; and

(d) the reasonable cost of any works to the Authorised Pipe-line shall be borne by the Grantor

THE THIRD SCHEDULE
GRANTEE'S OBLIGATIONS

1(1) The Grantee will not carry out any works involving entry into and/or upon the Grantor's Land without first obtaining and thereafter strictly complying with a permit to work to be issued in writing by the Grantor (which the Grantor hereby undertakes to issue without charge promptly upon request and upon reasonable terms) and will not carry out any such works unless the identity of the contractor carrying out such works shall first have been approved in writing by the Grantor (such approval not to be unreasonably withheld or delayed)

(2) In applying for any permit to work the intended works will be defined by the Grantee in detail and any application for such a permit will be in writing

(3) Any permit to work may include conditions which will be met strictly by the Grantee before during and after the carrying out of the works in question relating to (inter alia) maintaining to the Appropriate Standard safety and protection for personnel plant pipelines and other equipment likely to be affected by the works in question

(4) Any permit to work may be withdrawn forthwith if the conditions therein contained are not strictly complied with

at all times or if circumstances arise which make such withdrawal reasonably necessary

2. The Grantee will give the Grantor and any occupier of the Easement Strip as long notice as may be reasonably practicable of any intention to exercise such of the Specified Rights as involve the execution of works on the Easement Strip with a view to enabling the Grantor and such occupier to make suitable arrangements with respect to their activities and operations on the Grantor's Land The period of notice shall in any event (except in emergency) be not less than ten working days and all movements of pipes vehicles and machinery in the exercise of the Specified Rights will be carried out so far as is reasonably possible in accordance with a programme of which the Grantor and any occupier of the Grantor's Land shall be kept aware

3. The Grantee will ensure that at all times during the exercise of the Specified Rights all means of access along and across the Easement Strip and any land occupied by the Grantee as a working area are kept open and available for use by the Grantor or other the occupier of the Easement Strip whether by means of adequate temporary crossings or otherwise as may be reasonably required by the Grantor the Grantor making available such temporary facilities as may be reasonably requisite for such purpose and so that in particular and without prejudice to the generality hereof the access road shown coloured blue on the Plan shall be kept open and unobstructed at all times

4. The Grantee will provide all temporary and permanent underpinning and support for all buildings structures and apparatus of the Grantor in or adjacent to the Easement Strip required in the exercise of the Specified Rights or any of them and all such work will be carried out to the Appropriate Standard and shall be of proper design and sound construction and shall be securely placed to the reasonable satisfaction of the Grantor

5. All ditches open drains and watercourses interfered with by the exercise of the Specified Rights will be maintained by the Grantee in an effective condition during the period of any entry upon the Easement Strip in exercise of the Specified Rights and thereafter will be left in as good a condition as before such entry and in relation to the gully between the points lettered 'F' and 'G' on Plan 2 the Grantee shall obtain the Grantor's consent (such consent not to be unreasonably withheld or delayed) as to the method whereby the pipe-line is to be constructed across the same and shall ensure that the free flow and passage of surface water therethrough into Dabholme Gut is not interfered with

6. Where cathodic protection of the pipe-line is provided by the Grantee all buildings facilities and structures on or under adjoining land which are likely to be detrimentally affected shall be protected by the Grantee either by bonding in such buildings facilities or structures to the protective system or if the Grantor and the occupier of such buildings facilities or structures agree by some equally effective method Provided that in either case such reasonable facilities shall be afforded as the Grantee may require for this purpose Provided further that the provisions of this paragraph shall not apply to any buildings facilities or structures erected or installed after the date hereof otherwise than by the Grantor

7. Except in case of emergency the Grantee will where practicable give to all occupiers of the Grantor's Land prior notice of intended inspection or of any other intended entry in exercise of the Specified Rights All representatives of the Grantee and its servants or agents whilst so engaged will carry and produce on request adequate means of identification and all damage caused by such representatives servants or agents in the course of any such entry will be made good or compensation paid therefor Provided that nothing herein shall prevent the Grantee's servants or agents entering on any part of the Easement Strip forthwith and without giving notice or obtaining

approval in order to remedy a breach or leak in any part of the Authorised Pipe-line (subject to the persons so entering acting in accordance with the Appropriate Standard and taking all such safety precautions as in the circumstances may be reasonably practicable)

8. The Grantee will so far as practicable carry out reinstatement of damage caused in the exercise of the Specified Rights in lieu of paying compensation in respect of any such damage

9. Should the Grantee at any time after the construction and use of the pipe-line decide to abandon it the Grantee will render and keep the pipe-line harmless

10. The Grantee will comply with all requirements under:-

(1) the Pipe-lines Act, 1962;

(2) the Planning Acts;

(3) the Health & Safety at Work etc Act 1974;

(4) the Environmental Protection Act 1990; and

(5) all other relevant statutes and applicable regulations howsoever arising

in connection with the Authorised Pipe-line and/or the exercise of the Specified Rights

11. The Grantee will ensure that the line of the pipe-line is adequately delineated by marker posts

THE FOURTH SCHEDULE

ACKNOWLEDGED DOCUMENTS

Date	Document	Parties
19th September 1951	Conveyance	Tees Conservancy Commissioners (1) Imperial Chemical Industries Limited (2)
5th May 1978	Duplicate Grant of Easement	Imperial Chemical Industries Limited (1) BOC International Limited (2)
1st January 1988	Conveyance	Imperial Chemical Industries PLC (1) The Owner (2)

SIGNED AND DELIVERED AS A DEED)
by ICI CHEMICALS & POLYMERS)
LIMITED acting by a Director)
and its Secretary)

THE COMMON SEAL of AMOCO (U.K.))
EXPLORATION COMPANY was)
hereunto affixed in the)
presence of:-)