Comments on Advantica report R 8391 draft issue.

Sections highlighted in Yellow are key points which JPK believe should be incorporated into their final report.

Sec	Page.	Comment
Gen	All	The report occasionally suffers from separate sections having been written by different individuals. Some sections have large paragraphs with virtually no numbering, others have e.g. 4.3.3.1, a). Correct spelling of local landmarks (Sruwaddacon Bay) and overall revised report compilation advised.
Exec Sum	All	The report should clearly identify in the summary sections that the existing design is robust, sound and safe correctly designed and checked by competent persons. Additional safety features such as reducing the design factor can be identified to reduce still further the existing low risk level and address key concerns of the public, but there are many instances in the report where further detailed investigation by Advantica ends up noting that the original design has more conservative values and that the base design is sound. These need to be brought out in the report to provide a balanced summary view of the detailed contents.
	i / ii	Bullet 4 – No H_2S found, very unlikely as no WI planned and no other fields / pockets of gas planned.
	ii	Bullet 5 – add after …evidence, "at present"
	ii	Bullet 6. The statement on increase in risk is misleading as it implies higher risks than previously demonstrated. Re-word to state … show that the risk calculated by Advantica is significantly affected by an increase in pressure, although it should be noted that this starts at a very low level, and at its maximum risk level, is less than that calculated by Shell, due to a …. It is not clear how the uncertainty is recognised.
	ii	Bullet 7 – Use of IS EN 14161 should be used as the primary design code as there are no significant factors which would cause SEPIL to disregard the National Irish code for pipeline design. In the original design phase such a code did not exist, therefore use of BS 8010 was justified, this is not the case now.
	iii	Bullet 8 – The supplied document is not the correct one to use as this was a conceptual design document produced in June 2000 and should be discounted in this report. There is currently no intention to have subsea pressure control systems of the type indicated in this section.
	iii	Bullet 10 – Advantica ***have*** reviewed the overall concept, design and routing of the pipeline (see section 3). This should be reported in the summary section. It is clear that Advantica ***has*** undertaken a reasonable review of the overall concept, route selection and alternatives and endorses the options taken by Enterprise and given that this is a key issue in order to move the project forward, should have equal prominence with other aspects reported here. To hide behind the words "detailed examination" to avoid commenting on this issue is misleading and does not provide the required balance to the report that the detailed sections do.

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1	1	Did not include the water outfall line in description. Item 4 – gas is …exported from there ***via*** the Irish.. not to. BGE is building and operating the export pipeline.
1	1	Key concerns should add " ..expressed ***by members of the public*** regarding..
1	2	Given that the report identified the key concerns expressed by members of the public, the report should specifically address those concerns and "put them to bed", either in this section, or by reference to a specific section where the item in question is discussed. It is not sufficient in a report issued to the public to simply state that these are "addressed in the report", when they are prominently identified in the Introduction. Introduction also identifies that Advantica …also examined the selection process for the overall project design… See comments related to bullet 10 above.
2	3	Please provide a copy of the spreadsheet noted and documents reviewed as an appendix so that it is clear which documents and drawings have been reviewed and which haven't. This will form a key area of record in the future.
2	4	Presumably this section will include the CPI report here also as well as the Aldridge calculations (especially as it has its own appendix).
3.3	11	It should be noted for information that societal risk was included in the version of the QRA which was submitted to the DMNR and only removed recently from the latest version after review by SGSI.
4.1	13	Should use the Irish version of the EN code, Is EN 14161, which does not include the reference to PD 8010. SEPIL can use PD 8010 as a supplementary code and can state the required design factor of 0.3 or whatever is chosen in the design basis (as IS EN 14161 has higher design factors for "category 2" equivalent areas).
4.3.1	15	Pressure fluctuations of the size predicted by Advantica are not permitted by the terminal operational pressure limits. The operational aspects of the upstream pipeline are to operate at near fixed arrival pressure conditions by variations in the offshore well choke valves. For the onshore section of pipeline it is not true that the stress ranges are 39 N/mm2, and are planned to be much lower. Even if they are at this level, equivalent to approx 38 bar fluctuation, the number of allowable fluctuations is equivalent to five pressure fluctuations per day for 40 years. It is clear, based on the terminal arrival pressure range of 90 to 110 bar, that it will operate as a fixed pressure pipeline unlike the transmission system. The issue here is that this is a low to no fatigue level pipeline and much of this section and the use of a high level pressure test is not valid. Flow induced vibrations are not considered applicable, but will be checked.

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4.3.2	15	300 mm is standard separation distance from pipe to bottom of slab. The comment is not clear as to the increased separation. The dimension is minimum. Ditches have their own protection and typical drawing which can be submitted if required, but are similar to the road crossing. The marker slabs reference is so that the contractor does not need to have a single slab, but can use smaller pre-cast units which are simpler and easier to install. The point is that the slabs are there to identify the pipeline and are not structural elements. See drawing 842 and specific contractor drawings. See notes on drawings especially notes 3, 6 & 7
4.3.2	15	Requirement for "formal safety analysis" for road crossings. Not clear what is being requested. If recommendation to go to 0.3 design factor for the rest of the pipeline is accepted, then this point becomes irrelevant as the whole pipeline will be 0.3.
4.3.3.1	16	Clarification is required from the construction contractor on what the current method statement is for this section. The deeper the pipe is buried the higher the land slide load on the pipeline. The maximum depth of cover in peat may need to be limited. See also 4.3.3.2 Soil restraints a) comments below.
4.3.3.1	16	Given that both the Advantica and the JPK analysis shows that the pipeline will not over stress in the event of a land slide or slip, the purpose of measuring the stress is unclear. Also the point at which it is measured is not easy to judge. JPK would recommend that in certain areas, a fixed survey point is established which will allow measurements of the pipeline position to be made and assessed annually as part of the monitoring plan, using probes, ground radar and other sensing equipment to plot the location and see if the pipeline has moved or sunk over time. Stress calculations / modelling can then occur to judge how serious any movement is. It should be noted that the pipe D/T ratio is low and the pipe can withstand strain levels well in excess of yield. Allowable strain level could be calculated using the DNV limit state criteria to demonstrate the robustness of the design.
4.3.3.1	16	Report states " current construction specification..", but no reference is given and is a vague statement. Requires specific reference to ensure that everyone is aware of which document is referred to.
4.3.3.1	17	Finite element model a:– 2m element length used. Validation work done using 5 m elements.
4.3.3.1	17	Finite element model b: – A conservative 2D lateral buckling model is used. The vertical spring effects would act to reduce the load on the pipe from the land slide. The pipe would tend to rise toward the surface and the landslide pass under it.
4.3.3.1	17	Finite element model c: – Given the uncertainty about the loading, a UDL is considered to be a conservative model of the loading on the pipeline. A more detailed modelling of the loading could have been performed if the results had been considered critical.
4.3.3.2	17	Applied loading a: - It is not considered reasonable to have a land slide loading concurrent with a full shut pipeline shut in at 345 bar.

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4.3.3.2	17	Applied loading b: - The design temp of 50 Deg C relates to the whole pipeline. It is not possible for the onshore section of pipeline to see 50 Deg C . 20 Deg C is considered more a reasonable upper bound temperature for the onshore section.
4.3.3.1	17	Applied Loading e: – The secondary loadings listed are out of the plane of the land slip loading and are not considered significant when assessing the overall safety of the pipeline under land slide loads.
4.3.3.2	17	Soil restraints a). Passive soil strengths for a range of soil models and burial depths were calculated. At the time of the analysis the target depth of cover was 1.2m. The validity of 12.85 kN/m should be checked if depth of covers up to 4m are proposed by the installation contractor.
4.3.3.2	17	Soil restraints b). The soil strength was selected to represent an upper bound on the remoulded peat. Advantica acknowledge that 4 kPa represents "the upper bound on the remoulded peat". It is considered reasonable to use the average strength of the intact peat because the high strength peak will not slit and the pat strength tends to reduce as it flows.
4.3.3.2	17	Soil restraints c). The worse case loading direction and upper bound restraint conditions have been used.
4.3.3.2	17	Soil restraints d). The backfill details were not know at the time of the analysis. It is considered that the modelling of the backfill will not significantly change the results of the land slide analysis.
4.3.3.2	17	Allowable stress limits a). The BS 8010 limit of 90% is not considered relevant to a accidental loading of this type. The BS8010 allows strain level up to 0.5%. The DNV criteria was used because it equates to strain levels of 0.2%. It should be noted that the pipe could survive strain levels of up to 6% without risk of local wall buckling.
4.3.3.3	18	JPK consider that land slips parallel to the pipeline will not induce any significant loading on the pipeline. e.g. the lateral load case that was selected for analysis is the worst case. There are only 2 bends along the section of the route at risk from peat land slides. e.g. KP 90 and higher. JPK do not consider the presence of the bends will significantly change the results of the land slip analysis.

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4.5.2.1	24	It is understood that Shell Global Solutions have an in-house developed proprietary corrosion assessment method which they market as 'Hydrocorr' software. It is supported partly by Shell extensive in-house research and data. Preliminary calculations by Shell indicate that the JPK calculations are generally safe and conservative. The method used by JPK, based on Dewaard and Milliams is widely used throughout the offshore industry. The JPK method is similar to that accepted or even recommended by other operators such as BP. Note that the use of the inhibitor availability model, which was not widely accepted at the time of writing the JPK report (2001), for bottom of the line corrosion would not have affected the JPK predicted corrosion allowance since the top of the pipeline was predicted to have the highest corrosion rate. Advantica indicate that JPK should have adjusted the base case corrosion rate by a series of factors including the pH factor. It should be noted that the Dewaard and Milliams equation has the built in assumption of the pH of pure water. JPK did not include the other factors (glycol, scaling, pH) which would reduce predicted corrosion rate. This is a safe and cautious approach considering some uncertainties in the application of such factors. Shell would include these factors, based on extensive research, which would generally tend to reduce the corrosion rate and hence predicted corrosion allowance.

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4.5.2.2	24	The Advantica comments indicate that JPK predicted corrosion allowances are based on an assumed inhibitor efficiency of 95% which is potentially non conservative. To the contrary, JPK assumed an effective inhibitor efficiency of 90% in deriving corrosion allowances (See Section 3.2, Fig 4-3 of JPK report). Calculations were made assuming inhibitor efficiencies of 95% for water flowing in the pipeline. However, in assessment of corrosion at the top of the pipeline, due to condensing water on upper surfaces not reached by inhibitor, 10 % of the uninhibited rate was assumed as recommended in the referenced literature (Section 5 of JPK report). This equates to an inhibitor efficiency of 90%. The assumption of 10% reduction is a widely used, though crude approach, but Shell have a more sophisticated approach within their method. Advantica comments indicate that JPK should have used the inhibitor availability model. JPK agree that the inhibitor availability model is appropriate for fluids in the bottom of the pipeline. However, it is not appropriate to use the inhibitor availability model for top of the line corrosion, which is the basis of the JPK recommended corrosion allowances, since it is questionable if inhibitor will reach this zone. Furthermore, at the time of writing the report (2001) the inhibitor availability model was not as widely accepted as it is today. It should be noted that Shell have reported that their analysis predicts that methanol will inhibit the corrosion rate at the top of the pipeline tending to generally reduce the corrosion rate compared to JPK predictions. Advantica recommend a 0.05 mm/year lower limit in corrosion calculations. However, this is a, generally recommended, lower limit to be used in conjunction with the inhibitor availability model. It relates to the limitations of inhibitors. As stated above, the JPK corrosion allowances were based on top of the line corrosion for which the inhibitor availability model is not applicable.
4.5.2.4	25	JPK have selected a minimum corrosion allowance of 1 mm for cases where the predicted wall loss was less than 1 mm. This is common industry practice. Advantica indicate that a minimum of 3 mm, rather than the JPK value of 1 mm, may be applicable using an approach where corrosion allowances are selected from fixed values. This is an alternative to the calculation approach used by JPK . Calculation approaches are generally more rigorous and accurate than selecting fixed values.
4.5.2.5	26	JPK disagree with the Advantica comment that the corrosion allowance prediction does not follow industry best practice. The approach used by JPK is consistent with that currently recommended by major North Sea operators and is widely used though out the offshore industry.
5	30/31	The section on ignition should also state, for the avoidance of doubt, that gas releases in unconfined, open spaces do not “explode” in the same manner as TNT or as witnessed in confined spaces such as refineries, chemical plants etc.

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5.1.1	32	3rd para – The issue over damage caused by internal slugging appears on a number of occasions. Forces resulting from slugging inside buried, fully restrained pipelines have been calculated for other more extreme pipelines and are negligible in terms of the overall stress levels. Even in terms of end piping loads, these stresses are normally well inside the stress limits of the material. Therefore it is perfectly reasonable to not consider this as a credible Hazard. Also the predicted behaviour of the Corrib pipeline is that significant slug flow is not present during steady state operation, but predominantly during rapid ramp-up. Even then it represents only a portion of the pipeline internal diameter.
5.2	34,35	This section spends two pages discussing the population density and then finally concludes that it is "unlikely that if the analysis were to be repeated on a more cautious basis , that the population density calculated would take the pipeline into a higher class location.." This section should be reduced in size.
5.2	34	4th para on p 34. Ribbon developments parallel to the pipeline route are not considered to be worthy of designation as a "cluster", which is normally interpreted as a denser gathering of houses than normal, such as a small hamlet or gathering of houses at a crossroads. The spacing of houses along the key section is almost uniformly distributed along the 1.6 km strip parallel to the route. If ribbon development were closer to 90 degrees to the pipeline then this point would be reasonable, but this is not the case here.
5.3.1	36	The issue of H2S is mentioned in many locations. Reservoir engineering from SEPIL have responded, but it is normally recognised that in well defined fields and where there is no water injection, souring of reservoirs is not common. There are no facilities to inject water in the Corrib field or any plans to do this. Therefore whilst H2S action levels can be written in, this is not considered to be a major risk item and note should be made in the final report of this point.
5.3.1	37	2nd para. The land slip risk analysis occurred at the same time as the QRA latest revision and was left in to provide some level of conservatism in the QRA.
5.3.3	40	Societal risk was included in previous versions of the QRA including the one submitted to the DMNR, but later removed by SEPIL.
5.3.4	41	1st para page 41. The section on "increasing risk" should be revised to indicate that the start point is from a much lower point than in the existing QRA and therefore from the start point of the existing QRA, the overall risk levels go DOWN with reducing pressure.
5.3.4	40 to 43	This is a very long section without sub sections and results in some very large paragraphs. It would be more readable if broken up into sections and allow easier responses.
5.5	46,47	As noted before, this section considers a document which has not been used for design and needs to be replaced or removed.
6.1.2	50	First bullet – EN code for pipelines is 14161, not 14621. Bullet point is incorrect – wall thickness in 14161 is a design thickness and manufacturing tolerance is added to arrive at the nominal thickness. See section 6.4.1.1 in the code.
		Bullet 3 – use of the word variable should be qualified. Sub bullets addressed by response to recommendations

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	59	Bullet 6 - See previous comments above.
		Bullet 7 – Should be written without reference to class 2 areas as this is irrelevant and not proven – see earlier comment on section 5.2.
		Bullet 8 – should be removed as this was not the correct document.
	60	Bullet 10 – Should be expanded as the review did consider the overall concepts, route options and concludes that the existing design is satisfactory.
		Appendix B – I would suggest that the sections where these points are addressed is included to allow those who submitted the response or are sympathetic to the question can see where in the report they are addressed.
		Appendix C – Geotech review by JPK, but comes out with lower stresses and the same result. The JPK report was a relatively simplistic report using conservative assumptions compared to a very detailed analysis undertaken by Advantica.
C 2.1	71	It should be noted that the JPK FE model of the land slip conservatively includes the effects of axial feed in of adjacent sections. This explains why the narrow land slip models give higher equivalent stress results than the wider land slips.
		Appendix F – It should be stated in less technical language and refer to sections in his report that his base assumptions are incorrect. It would help if some of the grossly incorrect data is demonstrated, e.g. the calculation which shows 8 minutes to evacuate the whole pipeline contents versus hours in practice.