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Recd From: Brid McGarry

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Information Submitted P00/2434 by Brid Mc Garry re issues raised on the 24th April '07.

Gortacragher
Rossport
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Chief Planning Officer
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02/01/01

Submission Re: Planning Application to Mayo County Council for a Gas Treatment Terminal to be located near Ballinaboy Bridge in the townland of Bellagelly South, Glenamoy, Co. Mayo.

Threat to general wellbeing of local community

EIS 8.5.10.1. identifies two houses (human receptors) within a 2 km. radius of the Terminal. I expect that Mayo County Council will express genuine concerns for residents in the fourteen other houses, plus the two already mentioned, contained within this range i.e. some houses are within 500m. of the proposed site. There will be a high volume of traffic passing by in the vicinity of these houses on a daily basis and thus noise and dust levels (windblown effects) will be intolerable. These residents need to be informed of the proposed Terminal as it would appear that they were not consulted, as they did not exist on the planning EIS or the Terminal EIS prepared by RSK Environment Ltd. for Enterprise Oil.

Destruction of Fish in Carrowmore Lake

Carrowmore Lake is the EU funded water supply for the whole of Erris which includes the towns of Belmullet and Bangor i.e. areas of high population in the overall context. Bearing this in mind it is proposed to clear 26 hectares of peat for the Terminal site (44 hectares is the total site area). This liquid peat will run off during site clearance operations as it is of an unstable nature and since the area is subjected to very high rainfall (with a yearly average of 1500mm.) this will result in the accumulation of peat in the lake bed. Rock phosphate and other trapped nutrients from the site (located within the original An Foras Taluntais Peatland Experimental Station which was subjected to various experiments on crop productivity including forestry) will leach down with this peat via perforated site into local streams and result in eutrophication and "algal bloom" formations resulting in the deoxygenation of the water. This will in effect lead to the total destruction of salmon, trout and other species. Deoxygenation will lead to anaerobic conditions for putrefying bacteria which will result in a dead pungent, putrid mass with hydrogen sulphide emissions and other undesirable volatiles at the bottom of the lake. Tourist potential regarding angling will be wiped out.

clearance in excess of 1 million cubic metres (conservative estimate) will have to be filled in i.e. hugh foundation fill required and all this before a basis foundation level will be reached. More delivery lorries will have to be taken into account in addition to the realistic estimate of 200 to 300 plus lorries per day.

Inhouse Power Station using Condensate as Generating Vector

EIS 4.3.7. This section seems to suggest that the operation of the plant will require in excess of 120 MW capacity which would be generated on site using condensate (a byproduct of the gas purification process). The capacity of Bellacorick Peat Burning station is one third of this output. This would constitute a major development and we are sure that Mayo County Council will refer to the relevant bodies regarding same. Planning for such a development should take years and requires a separate EIS for planning submission purposes.

Inhouse Concrete Batching Outlet

EIS 6.3. "Piling of the site will be carried out using the cast *in situ* technique". "It is possible that the contractor may set up a small batching plant on site for the purpose". If this statement is to be realistic then again a separate planning submission for a concrete batch plant is required and relevant EIS for same for the attention of Mayo County Council.

Installation of Mechanical Refrigeration Unit

EIS 4.3.3. "Further depletion of reservoir pressure requires installation of mechanical refrigeration and re-wheeling of the sales gas compressor".

This statement would appear to suggest that CFC technology or technology of a similar nature would be employed. As this is very vague, a separate EIS and planning submission would need to be submitted to clarify safe disposal techniques. The recent Kyoto symposium governing international states emphasised that international companies must reduce by a similar amount to their new emissions, the amount of emissions they produce elsewhere. Under Kyoto we cannot allow Enterprise Oil to generate new greenhouse and ozone-damaging emissions without paying the cost.

Impact on Tourism

During the construction stage of the Terminal local businesses and accommodation providers will be adversely affected and this will have a detrimental effect on the local economy. There will be access problems on all entry routes as they will be taken over by heavy lorries, machinery etc. Tourism related business will be wiped out in the short and long term. The unspoilt rugged landscape which characterises the area will be dominated by a gas processing Terminal consisting of four chimney stacks up to 40m. high. Screening using trees around the site is suggested in the EIS but we are not familiar with any tree species which can grow to 40m, which can tolerate toxic gaseous emissions, extreme noise levels and which can withstand gales in excess of 100 m.p.h. The Terminal and ancillary buildings will be a total blot on the existing landscape.

conclusion

It would appear that the authors themselves have no faith in this particular application so therefore why should Mayo County Council Planning Authority.

Yours

Brid Mc Garry B. Agr. (Food Science & Chemistry)

c.c. Mr Noel Dempsey, Minister for the Environment
An Taoiseach Bertie Ahern
An Taisce
An Bord Pleanala
Mr Vincent Roche, North-western Fishery Board
European Commission for the Environment
Patricia Mc Kenna M.E.P.

N.B. Three pages of signatures were also enclosed with submission multinational companies, of which thankfully there are many in this country, provide employment and pay their taxes.

Mr. Sargent: Is the Taoiseach sure about that?

The Taoiseach: To a substantial extent, the money they spend here benefits the economy. That is a general rule.

Mr. Sargent: It does not apply in this case.

The Taoiseach: If we took the ideological view and decided that private companies were not welcome here, that would be an extraordinary position to take.

Mr. Sargent: I am talking about Shell.

Caoimhghín Ó Caoláin: Were any agreements, understandings or conclusions reached in the course of the Taoiseach's meeting with the president of Shell and his colleagues? Has he - or the Minister for Communications, Marine and Natural Resources or the Minister for the Environment, Heritage and Local Government, who also met with the delegation from Shell - had any further contact, either directly or in writing, with the president of Shell regarding the matters discussed?

Does the Taoiseach agree that instead of selling off such important State resources to companies such as Shell, it would be better to have a radical revision of the licensing and revenue structure which governs this sector? We need to see major reform under which the State's 50% stake in all oil and gas deposits is restored. The Taoiseach mentioned that Shell was a tax contributor, but would it not be better if companies such as Shell paid the same rate of corporation tax as all other companies instead of receiving preferential treatment as they currently do?

The best option would be for the gas from the Corrib field to be piped into an all-Ireland grid. Those of more informed opinion than I have suggested that to do otherwise would result in a significant reduction in the supply of natural gas to consumers throughout the island of Ireland.

*

The Taoiseach: I do not agree with the Deputy's last point. At the moment we are at the end of a pipeline that gives us access to almost unlimited amounts of gas from Russia. Those who know more about this than I do can see the potential down the road. If this resource works effectively, as some of the early studies suggest, we could be exporting gas to the UK.

I do not see what the Deputy means about employment. Shell does a great deal of business and has invested heavily in this country. The Deputy said it receives preferential treatment but this is not the view of anyone in Shell's world or European management. Other countries have ways and means of treating large companies with which I do not agree. We have a very open and transparent system. I can imagine what would happen with a project such as this in most European countries. Perhaps those countries are wrong and we are right. I subscribe to that and I defend our position.

There were no deals or arrangements other than those I mentioned, including the letter to which I referred in my initial reply. Normal consultation with officials took place.

Northern Ireland Issues.

Ap D Appendix J

A CRITIQUE OF THE OPERATIONAL METHODOLOGY AND PROCESS COMPONENTS AT THE PROPOSED BELLANABOY BRIDGE GAS TERMINAL, COUNTY MAYO, EIRE.

BY PETER ROSSINGTON B.Sc. (Hons) M.R.S.C.

The benefits of using natural gas as a fuel for power generation in an expanding economy are well known. In fact, in section four of the Environmental Impact Assessment (EIA), for the proposed Bellanaboy Bridge gas terminal, they are even documented. It is stated that, "As the demand for energy increases, it is expected gas will have will have an increasing importance because of the efficiency of energy use in combined cycle gas turbine generators and the resulting relatively benign environmental impact of the emissions". From this statement, and other similar ones throughout the EIA, it is possible to think that Enterprise Oil and its partners understand the importance of energy efficiency and the need to keep toxic emissions to an absolute minimum. However, when the operational methodology and process components for the proposed terminal are studied, the impression is given that at their own facilities Enterprise Oil apply other principles. The proposed Bellanaboy Bridge terminal incorporates some the worst gas terminal design, that actually maximises emissions, minimises energy efficiency and, due to the need for residual construction throughout its lifespan, maximises disturbance for local residents.

Throughout the EIA, the impression is given that Enterprise Oil care greatly about the environment, but their words seem meaningless when the equipment specification is studied and the consequential emissions are considered. In most peoples minds, minimising the impact to the local environment means employing processes and equipment that produce the minimum emissions possible with current technology. However, minimising the impact on the local environment to Enterprise oil seems to mean, with a few exceptions, meeting current legislative requirements for emissions. Many local residents around the proposed terminal have realised the distinction between these two very different definitions given to the same term, and have consequently become very concerned about what this might mean for their health and local environment. This is very understandable when the history of industrial development, and its effects on the environment, is considered. For example, discharges of toxic metals from factories in both Europe and the United States for many years met the legislative requirements of various national governments until it was discovered huge areas of estuaries, rivers and lakes were highly polluted. A classic example of this was lake Michigan, which in the late 1970's was found to contain unacceptable levels of mercury and cadmium. The cause of the pollution was numerous plants discharging supposedly "safe" industrial effluent into the lake. Many of the plants responsible for the pollution were not fitted with technology that could have reduced the emissions of heavy metals to virtually nil, even though it was in existence and well proven.

To truly have a minimum impact on the environment, Governments and companies must adopt a target zero approach, and use technology and practices that minimise or completely stop toxic emissions and maximise energy efficiency. This is something Enterprise Oil has not done at the proposed Bellanaboy Bridge terminal.

At the proposed Bellanaboy terminal sweet gas from the Corrib field will be processed to national transmission line standards by adiabatic expansion through a Joule-Thompson valve. The adiabatic expansion of the gas will cause cooling and consequently the drop out of water and hydrocarbon vapour in the gas, which in turn will give it an acceptable dew point for transmission. Whilst not requiring any energy inputs adiabatic expansion does result in a significant pressure reduction, which consequently results in the requirement for downstream compression of the gas to transmission line pressure. This compression does require energy input, and at the terminal it is proposed that this should come from a gas fired turbine compressor package that will be a large producer of nitrogen oxides and carbon monoxide.

At many gas terminals, adiabatic expansion is not the preferred method of cooling the gas for dew point control. Instead, the gas is fed through a series of heat exchangers, cooled on one side by a mechanical refrigeration unit that uses either propane or a HCFC refrigerant medium. This method does not result in a significant pressure drop in the gas pressure, and therefore, providing input pressure is above transmission line pressure, compression after treatment is not required. Mechanical refrigeration also requires the input of mechanical shaft energy and at many terminals this is supplied either by gas fired engines or turbines. These engines can also be large producers of nitrogen oxides and carbon monoxide. However, at smaller processing units, large electrical motors are sometimes used as the source of mechanical shaft energy. (An example of a plant that utilises this technology is the old Hamilton Brothers plant located within the Amoco complex at the Bacton terminal, Norfolk, United Kingdom. Two processing streams with a combined processing capability of 500 mmscfd operate of two large electrical motors powering two compressors using KLEA refrigerant.)

Adiabatic expansion is not the most suitable processing technology for the proposed terminal for two principle reasons :-

1. Emissions are maximised per unit of gas processed
2. Adiabatic expansion can not process gas for the proposed lifetime of the terminal

Emissions are maximised per unit of gas processed because of two factors :-

a. Compression of natural gas is more energy intensive than refrigerant compression
b. Turbine driven machinery is only 30 - 35% efficient at converting fuel energy to mechanical shaft energy

The EIA states that a 7.7MW turbine is required for the compression of the gas after the Joule-Thompson valve, but if a mechanical chilling system was used, only a 2MW turbine would be required for processing the same amount of gas.[1] Assuming both turbines produce similar levels of emissions per megawatt generated, the higher energy input of the 7.7MW turbine would result in approximately three and a half times more emissions than the 2MW machine. Therefore, adiabatic processing is three and a half times more energy intensive, and polluting, than mechanical chilling.

Unfortunately, turbine driven machinery also suffers from the drawback that it is very inefficient, with only 30-35% of the input energy being converted to mechanical shaft energy. Electric motors are far more efficient at converting input energy into mechanical shaft energy, with efficiencies as high as 90%. Electric motors also have the advantage that they do not directly produce nitrogen oxides or carbon monoxide

[1] Figure taken from a 500 mmscfd plant using a Ruston TA1750 for mechanical refrigeration.

Therefore, an electrically driven refrigerant compressor, if powered in a certain way, is far more advantageous for the environment and energy efficiency. (Electricity generation also results in emissions of nitrogen oxides and carbon monoxide, so it is possible to argue that using electrical motors does not really stop pollution. However, this point will be addressed later.)

The EIA admits that around year nine of the proposed plant's twenty year lifespan, mechanical refrigeration will have to be installed. The natural drop off in the inlet pressure, as the wells are used and become depleted, will result in insufficient adiabatic expansion and cooling to meet the dew point requirements. Therefore, mechanical refrigeration will have to be installed and used to ensure the export quality of the gas. For anybody not familiar with gas processing, the installation of a major chilling plant is not a simple operation. Major construction will be required at the terminal in year nine, the extent of which will nearly equal the major construction currently proposed. This construction will once again result in large scale disruption to the life of local residents. If it is taken into account that mechanical refrigeration is a more efficient processing technique than adiabatic expansion, it will be required in year nine of the terminals life anyway, and local residents should be inconvenienced as little as possible by the proposed terminal, then Enterprise Oil should incorporate mechanical chilling into the current design of the terminal.

Two further issues should also be considered about the gas processing, and they are :-

1. The type of refrigerant used in any mechanical chilling system
2. The need for the installation of the proposed gas compressors

The EIA makes reference to the use of propane as the refrigerant medium in the proposed mechanical chilling system to be installed in year nine. Whether, a refrigerant system is installed either in year nine, or at the beginning when it should be present, it is surprising to see that propane is being considered as the chilling medium. Propane is a highly flammable gas that by its presence alone causes increased risk for local residents and terminal operators alike. If Enterprise Oil truly wants to reduce the risks for their operations staff, and local residents, they should not select either propane or ammonia as the chilling medium. Instead, a modern HCFC stable refrigerant should be selected. While HCFC still poses a potential threat to the environment, through depleting the ozone layer if released, proper controls should ensure minimal refrigerant is released from the system.

Whilst mechanical chilling is preferential to adiabatic expansion followed by gas compression, it is important to stress that it is the opinion of the author that the gas compression units still be completed in the original construction phase of the terminal. As the wells become depleted and the gas pressure falls it is likely that some compression will be required to meet the export pressure requirements. If the compressors are not installed in the original construction phase, this could again cause disruption for local residents at a later date when they are installed. As they will not be required in the initial stages of operation, if mechanical chilling is used, a set of bypass pipework will additionally be required. This however should not be difficult to incorporate in the design. It is important to stress that the compressors should be driven by electric motors, and not turbines as currently envisaged.

It is stated in the EIA that there is no external grid power for the site and therefore gas driven electrical generators are required. This is again an example of where Enterprise Oil could have chosen better equipment and have missed opportunities to minimise the impact of the proposed terminal on the environment.

It is virtually acknowledged by everybody involved in fossil fuel generation that the only way to meet the requirements of the Kyoto protocol is to build more combined heat and power (CHP) plants that increase the efficiency of generation by utilising waste heat. As well as helping to meet the requirements of the Kyoto protocol these plants also offer the advantage of cutting the net toxic emissions from power plants. At the proposed Bellanaboy Bridge terminal, Enterprise Oil plan to generate electricity using gas fired compression engines that really do not allow for large scale utilisation of waste exhaust heat. In addition to selecting engines that do not allow for much utilisation, Enterprise Oil have also not incorporated any waste heat utilisation into their design.

Earlier in this critique it was argued that the main mechanical shaft energy requirements of the terminal should be met by electric motors, due to the efficiency of energy conversion and the fact that electric motors produce no direct pollution. Despite electric motors not producing any direct pollution, it must be acknowledged that electricity generation does result in the emission of nitrogen oxides, carbon monoxide and in some cases, depending on the fuel, particulate emissions as well. However, if the electrical power for the electrical motors is supplied by a CHP plant, the net toxic emissions for the terminal overall can be greatly reduced.

At the proposed terminal, a 15 MW base duty (43 MW net thermal input) gas fired turbine generator, with a waste heat boiler, should be part of the design. This would meet the electrical power requirements of the plant, both at the beginning and end of its life, and its thermal power requirements, but reduce the output of nitrogen oxides and carbon monoxide by as much as 82% and 97% respectively.[2] Modern gas turbines can be equipped with abatement technology to produce less than two and a half parts per million of nitrogen oxides and one hundred parts per billion carbon monoxide per cubic metre of exhaust gas. It is more than likely at the beginning of the proposed terminals life, 15 MW of electrical power will greatly exceed the power demand of the plant. Therefore, the terminal design should incorporate a power cable to the grid, and any excess power should be exported for sale. As the nearest grid point seems to be some miles away, this will increase capital cost, but this should not be used as a reason by Enterprise Oil to install the plant if they truly care about the environment and the effects of their operations on the local environment.

The greatest advantage of a CHP plant would be that the proposed heating medium heater would not be required. It is stated by the EIA that the greatest impact on air quality will come from emissions of nitrogen oxides, and, whilst nitrogen oxides will be one of the major emissions from the proposed terminal, more toxic emissions that are likely to have a very negative impact on health should be of greater concern. It is proposed by Enterprise Oil that the heating medium heater should be fired on stabilised natural gas condensate from the Corrib field. This is very concerning because it is likely that the condensate will contain a number of toxic heavy metals that will be released into the environment when the condensate is burnt. The EIA gives no major details on the different heavy metals present in the condensate, apart from mercury, and therefore the likely emission rate of them. It admits that if the condensate is not treated emissions of mercury will be unacceptable, but only mentions treatment of the condensate for mercury. However, the type of treatment for mercury removal is not described. The EIA should give details on all the metals present and the likely emission rates, as well as the details of the proposed treatment system for metal removal.

Another undesirable consequence of using condensate as fuel, is emissions of all particulates will be higher than if the plant was fired on gas or not used because of the presence of a CHP plant. The EIA gives no details of what the likely ambient concentrations of particulate matter

[2] Based on the figures calculated in appendix 1 of this critique

will be from the terminal. This is concerning, because of all of the likely emissions, fine particulate matter is likely to have the most negative impact on health at very low concentrations. It should be shown that the ambient concentration of fine particulates under all conditions will not breach the most applicable air quality standard, that of the United States Environmental Protection Agency, that states fine particulate matter (that under 2.5 microns in size) should not exceed 15 micrograms per cubic metre.

It is greatly concerning that the EIA has also not studied human exposure to toxic species emanating from activities at the proposed terminal. For example, whilst the combustion of condensate might result in acceptable ambient concentrations of metals and other fine particulates, the build up of these substances in the local environment could result in exposure that in the long term could result in health damage. Metals do not just disappear from the environment once released into it, and some organic compounds can also be very persistent. Therefore, exposure can be far greater than that calculated by resultant ambient air concentrations. Most heavy metals accumulate in biological systems and this can have long term consequences for human health. The EIA also does not give any details on the likely exposure to radioactive species that could certainly be released if condensate was used as a fuel. This is completely unacceptable.

Due to the risks it poses to human health, the use of natural gas condensate as a fuel should not be allowed at the proposed terminal. The stabilised condensate should be collected and then tankered off site to a refinery where there should be appropriate equipment for dealing with its metal content. If stabilised correctly, this should pose no more hazard than a tanker moving petrol around.

At many United Kingdom gas terminals over the last few years there has been great effort put into reducing emissions of methane and VOC's, so that the requirements of the Kyoto protocol can be met. While it is impossible to completely stop these emissions, this is again an area where Enterprise Oil have missed opportunities to reduce emissions. By selecting fixed roof tanks that vent to atmosphere, and using a flare for dealing with gas from equipment depressurised for maintenance, annual emissions will be higher than necessary. Depressurisation vents and breather vents should all be fed to a low pressure recycle system. The system could simply consist of a vessel held just below atmospheric pressure by an electric motor driven compressor that operates on demand when the pressure in the vessel rises due to discharges from vents. The compressor should discharge into the inlet of the treatment facilities so that the gas can be re-used rather than wasted. Whilst, if all equipment is working correctly, venting emissions should be reasonably low, plant design should cater for the fact that at times plant can operate incorrectly and cause large emissions. At the Amoco terminal, in Bacton, Norfolk, the condensate stabilisation column malfunctioned. This resulted in emissions from the condensate tank, due to unstabilised condensate, being over one hundred times the estimated and allowed level. It was over a year before it was realised the situation was occurring. A similar situation could easily occur at the proposed terminal.

The EIA also makes no reference to emissions from the methanol reboilers. It is stated that condensed methanol from the still flows to accumulators, and if the accumulators are similar to others on methanol reboilers they will have atmospheric vents on them. Aromatic hydrocarbons found in condensate are appreciably soluble in methanol and will pass into the reboiler with the methanol. They will then evaporate off with the methanol and pass into the accumulator. If the overhead condenser does not cool the methanol and aromatic hydrocarbons substantially, the hydrocarbons will stay in a vapourised state and pass out into the environment through the vents. This can be a cause of significant emissions, and therefore if there are vents on the accumulators they must be connected to a vapour recovery system.

In section 10 of the EIA it is stated that "Enterprise Oil are considering installing air quality monitoring equipment in the vicinity of local housing after the terminal has commenced operation". Any company that is truly concerned about the effects of its operation on local communities would give a firm commitment to monitoring to ensure its emissions are not having an impact on residents health. It is also important that the company, as well as giving a firm commitment to monitoring, are more specific about the type of monitoring to be carried out and what they will offer in terms of compensation if they do break air quality standards or expose residents to harmful emissions. It is concerning that in section 10 it is proposed air monitoring will be carried out using passive diffusion tubes. Air monitoring must be carried out using real time monitoring equipment, so that any large scale emissions are not averaged out and it can be seen if short term air quality standards are broken. The following emissions must be monitored by Enterprise Oil, and preferably by the methods listed :-

1. Nitrogen oxides, analysed using a chemiluminescence monitor.
2. Carbon monoxide, analysed using a non-dispersive infrared monitor.
3. Ozone, analysed using an ultraviolet absorption monitor.
4. Benzene, xylene, toluene and ethyl benzene, determined by gas chromatography.
5. Mercaptan, determined by gas chromatography.
6. PM2.5 & PM10 particulates, determined by a beta attenuation monitor.

In addition to the above continuous monitoring, quarterly analysis should be carried out on the composition of the particulate matter. This monitoring must check that emissions of mercury, radioactive substances and other metal are highly limited and within orders of magnitude close to background levels.

Whilst the treatment of different aqueous effluents, with different characteristics, precludes the use of one simple water treatment system at the terminal, the proposed treatment system, and its operational methodology, pose many questions and concerns. For example, it is concerning that the EIA for the aqueous effluent uses many assumptions and relies on further work being undertaken on the performance of many pieces of equipment. It is also concerning that no figures are given on the volume of waste that will be produced as the result of the treatment plant, the impact of this waste on the environment or on safeguards if one or more pieces of equipment fail to perform adequately.

The aqueous effluent poses a threat to the aqueous environment because of two principle types of contamination;

- heavy metals in the produced water
- organic compounds in both the produced water and collected water

(Collected water being the term used for collected rainwater, sanitary water and firewater. The term organic is used in its chemical sense of referring to carbon based compounds and not in the sense of something being environmentally friendly.)

The proposed treatment system is supposed to deal with the contamination in both types of water and produce a reasonably pure effluent, but few answers are provided in the EIA on what the concentration of species will be in the final effluent and what will occur if the system doesn't perform correctly and the effluent isn't to specification. The EIA states that the concentration of the different contaminants in the effluent will be at, or below, EQS levels, but does not state clearly what these are.

The primary concern of what will occur if effluent leaving the treatment plant isn't to specification must be addressed by Enterprise Oil. The EIA states that monitoring will be undertaken to ensure effluent is at the required specification, but again the EIA is short on actual detail. From information in the EIA, it seems possible that the concentration of heavy metals in the effluent will only be determined once a year. Therefore, in theory, the dissolved air flotation (DAF) unit for removing heavy metals could malfunction one week after measurement and not be corrected until a year later, in which time large amount of heavy metals might be discharged. To guarantee the protection of the environment, Enterprise Oil must install online monitoring for all the following of the following parameters :-

- pH
- total organic carbon
- suspended solids
- polyaromatic hydrocarbons and phenol
- ammonia and total nitrogen
- sulphides
- all heavy metals

Probes, ion specific probes, continuous sampling chromatographs and specific component analysers are available for measuring all of the above parameters. The results from the online equipment must be fed into a computer control system that will stop discharge of the effluent, by an interlock, if any of the parameters are out of specification. The interlock could be as simple as a relay switch that stops the discharge pump working if the effluent is out of specification. It must be part of the systems design that the interlock can not be easily over ridden by anybody on the plant, and if it is, must be done in the presence of an independent witness.

The concern about the actual performance of the plant must also be addressed by Enterprise Oil. Hard data on the treatment plants performance must be given. Stating that EQS levels will be met is not satisfactory. The concentration of some pollutants, for example heavy metals, might be several magnitudes of order larger than natural background concentrations, and will consequently mean that the receiving environment (Broadhaven Bay) is still effectively a dump for industrial effluent. For contaminants such as heavy metals, the concentration in the effluent should be equal, or less, than natural background levels found in seawater in Broadhaven Bay.

One of the principles listed in the EIA for the management of wastewater is "recycle where practicable". This is an excellent principle, but does not seem to have been greatly incorporated into the design of the water treatment plant. Treatment of such a complex effluent as the produced water will always result in some sort of external waste, but the current design does seem to maximise the production of this waste. Improvements could be made on the recycling of contaminants if other technologies were employed.

For example, if the produced water was flash distilled to remove salts before being mixed with collected water, tertiary treatment of the effluent could be by reverse osmosis (R.O.), with back up treatment by GAC if the R.O. plant failed or very large volumes needed to be treated quickly, as would be the case in the event of a fire. An R.O. plant could concentrate the organic pollutants in the raw water by as much as 9 times, while 90% of the incoming effluent could be discharged as clean water. The concentrated effluent on the raw water side of the membranes could then be recycled to the condensate / methanol separation vessel, allowing maximum recovery of organic pollutants. A small proportion of the clean water from the R.O. plant could be fed to the flash distillation unit to re-dissolve the precipitated salts.

This solution, still contaminated with heavy metals, could then be fed to the DAF for heavy metal removal. The cleaned saline solution could then be mixed with the clean water from the R.O. plant to produce a solution fit for discharge. If certain ion exchange resins were used for the removal of heavy metals it might also be possible, if the correct metallurgical works exist, to reclaim many of the metals. The DAF unit precipitates heavy metals as the insoluble hydroxides or sulphides. These precipitated salts are then removed with other suspended solids in filter systems. However, by mixing the precipitated salts with other suspended solids, reclamation becomes far more complex and difficult. (In the supposed BAT assessment of treatment technologies for effluent clean up, ion exchange is stated as having the same problems as membrane technology. Whilst the assessment of membrane technology is far from perfect, the comment about ion exchange resins is very short on facts. There are at least two manufacturers who produce complexing resins especially for the removal of heavy metals from aqueous streams. Due to the fact that these resins only interact with the unique d-electron chemistry of heavy metals, they will not suffer from the normal drawbacks of ion exchange resins.)

Whilst it is possible to argue this system will require extra energy, has increased complexity and hence a greater risk of malfunction, it is also possible to argue that it brings many advantages. For example, if the DAF unit were to malfunction, only the salts produced in the flash distillation unit would have to be tankered off site for disposal, where as with the current system all off the effluent would have to be taken off site for disposal. The argument about extra energy use would also not be applicable if, as suggested earlier, a CHP plant was installed to meet the power and heat requirements of the site. It should also be remembered that vacuum distillation could be applied to the flash unit, therefore only minimally increasing the amount of energy used in the plant.

From conversations with local residents around the proposed terminal, it seems that Enterprise Oil are promoting the Bellanaboy terminal as a state of the art facility, and consequently local residents have nothing to fear from its presence or operation. However, as this critique has shown, the proposed terminal is far from being state of the art and does not incorporate technology that will minimise emissions, or maximise energy efficiency. Therefore, whilst the pollution impact of the terminal might be reasonably small, it can not be said to negligible, and local residents are right to be concerned. If Enterprise Oil are truly concerned about their impact on the environment and the communities in which they wish to operate their facilities, they must now consider re-design of the terminal to incorporate many of the components mentioned in this critique and truly produce a state of the art facility.

Peter Rossington B.Sc. (Hons) M.R.S.C. P.G.C.E.
20th September 2001.

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Appendix 1

Below is a table that shows the major nitrogen oxide and carbon monoxide emission sources for the proposed terminal. For each component at the terminal the predicted emission level is shown. The last column shows the power required for an equivalent piece of equipment if a CHP plant was installed instead.

(The CHP power required was calculated from the power rating of the component, assuming an equivalent electrical motor was 90% efficient and an equivalent thermal plant was 60% efficient. Although not part of the current design, refrigeration units have been included to show future power requirements.)

Component	Power Rating (Megawatts)	Thermal Input (Megawatts)	NOx (tonnes per year)	CO (tonnes per year)	Power Req'd (Megawatts)
Heater	5.0	7.1	7.262	1.816	8.3 (thermal)
Compressor	7.7	25.7	18.789	25.053	8.6 (electrical)
Generators	2.1	2.4	49.270	85.067	2.1 (electrical)
Refrig. Units	2.0	5.0	N/A	N/A	2.3 (electrical)
TOTALS		40.2	75.321	111.936	

As can be seen, if refrigeration units are included, the thermal input for proposed components is nearly equal to a 15 MW base duty (43 MW net thermal input) CHP plant.

However, while there is little difference in thermal input, the effect of a CHP plant on emissions must be considered.

The proposed components result in 75.321 tonnes of nitrogen oxides per annum and 111.936 tonnes of carbon monoxide per annum.

A 50MW base duty (125 MW net thermal input) General Electric LM6000 gas turbine, fitted with the latest abatement equipment, will produce 43.8 tonnes of nitrogen oxides per annum and 8.760 tonnes of carbon monoxide per annum.

If a 15MW base duty turbine produces similar emission figures to the LM6000 per MW, then the expected nitrogen oxides and carbon monoxide emissions will be :-

15/50 x 43.8 = 13.14 tonnes of nitrogen oxides per annum
15/50 x 8.76 = 2.62 tonnes of carbon monoxide per annum

Therefore, the reduction in NOx from the CHP plant would be :-

$$\{(75.321 - 13.14) / 75.321\} \times 100 = 82.5\%$$

The reduction in CO from the CHP plant would be :-

$$\{(111.936 - 2.62) / 111.936\} \times 100 = 97.6\%$$

Corrib Onshore Gas Pipeline
Community Update

APRIL 2007

Inside:

People who attended our Open Day in the Broadhaven Bay Hotel, Belmullet, on 27th February 2007 asked a number of technical questions about the pipeline. This newsletter attempts to answer the main points as clearly as possible.

Anyone who would like further information on these or any other issues, is welcome to contact us on:

Phone: 097 20720 *Email: routeinfo@rpsgroup.com*

Introduction

There are three factors that influence the safety of any pipeline:

1. Planning and Design
2. Construction
3. Operation and Maintenance

Where all three stages are carried out carefully and to a high standard, the pipeline will be safe. The Corrib pipeline has been designed with safety as its highest priority.

RPS Corrib natural gas

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Planning and Design

Corrib Onshore Pipeline Design

The pipeline will have a diameter of 508mm / 20" and wall thickness of 27.1 mm. To put this in context the Bord Gáis pipeline linking the ring main in Galway to the terminal at Bellanaboy is 9mm thick in most places. It will be made of high grade carbon steel (Grade 485, DNV OS-F101 specification) and will be capable of safely transporting the gas from the Corrib field.

Pipeline Pressure

The onshore section of the pipeline will normally operate at pressures of 100 – 120 bar. It has been designed to withstand pressure of up to 345 bar as the initial gas well pressure of the Corrib field is 345 bar. This was an original design consideration to cater for the possibility that the pressure in the pipeline could build to gas well pressure during exceptional circumstances— it was never intended for the pressure in the Corrib pipeline to reach 345 bar.

Some important things to note about the design of the onshore pipeline are:

- In accordance with the recommendations made by Advantica following their review, a pressure-limiting valve will be installed at the point the pipeline comes ashore. This valve will shut off the onshore section of the pipeline before the pressure rises above 144 bar.
- By limiting the pressure in the onshore pipeline to 144 bar the Corrib onshore pipeline will operate with the most conservative design safety factor used in Ireland.
- Pressure in the Corrib gas reservoir will naturally reduce, as the gas is produced. After 5 years of production, the maximum gas pressure at the gas wells will have dropped below 144 bar and gas pressure in any part of the pipeline will not exceed 144 bar.

Independent Safety Review –'The Advantica Report'

On behalf of the Department of Communications, Marine and Natural Resources, Advantica (UK gas consultant) carried out a comprehensive independent review of the Corrib onshore pipeline. Some of their key conclusions and recommendations were:

- Proper consideration was given to safety issues in the selection process for the preferred design option and the locations of the landfall, pipeline route and terminal.
- Pressure in the onshore pipeline should be limited to 144 bar. This measure results in a lower risk level and achieves a higher design safety factor.

The recommendations of the Advantica Report have all been accepted and work is now in progress towards implementing these.

Statutory Approvals

Approvals for the Corrib Pipeline will be required from An Bord Pleanála (under the new Strategic Infrastructure Act) and from the Minister of the Department of Communications, Marine and Natural Resources (DCMNR) under the Gas Act and under the Foreshore Act (Coastal Zone Management Division). The application process for these approvals will include the preparation of an Environmental Impact Statement (EIS) and consultation with landowners and the local community.

Route Selection Process

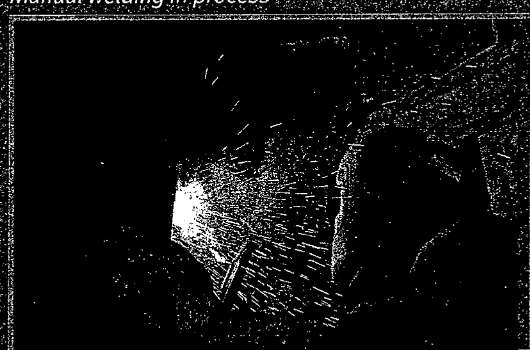
The route selection process will involve assessing a wide range of criteria and consultation with the local community on these and other possible criteria. Route selection will involve the following basic steps:

- Define Study Area
- Identify Route Corridor Options
- Select Preferred Routes
- Decide Final Preferred Route

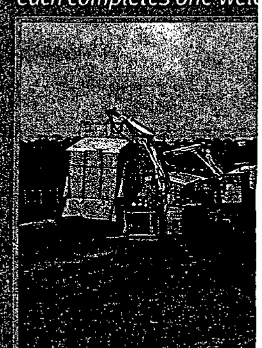
The final preferred route will only be selected following ongoing consultation with the local community. It will be presented to An Bord Pleanála and the DCMNR with the relevant statutory applications (Strategic Infrastructure Act and Gas Act respectively).

Pipeline sections laid out and ready for welding

Manual welding in process



"Train" of automatic wel
each completes one wel



Construction

Typical Construction Process

The sequence of pipeline construction on land begins with fencing off the working area (approximately 40m wide) and topsoil stripping within this area. This topsoil is not removed, but is kept to one side; it is not mixed with subsoil and it is replaced as the topmost layer during reinstatement.

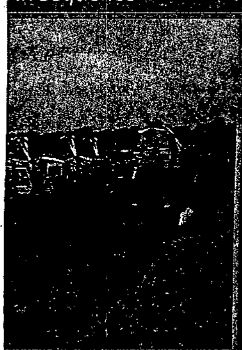
Once the topsoil has been cleared, individual lengths of pipe (typically 12m long) are laid out and then welded together. In the case of the Corrib Gas pipeline, welds will be inspected before the pipe is buried in the ground; any defects will be repaired or cut out and re-welded. All transmission pipelines (upstream and downstream) must be pressure tested before being commissioned for service. The assembled pipeline will also be pressure tested using water at a pressure in excess of 500 bar.

The pipeline will be laid in a trench with a minimum depth of cover of 1.2m (approximately 4ft). Once the trench has been filled in and the soil reinstated there will be no evidence that the pipeline is there at all. For this reason markers will be installed to help locate the pipeline (eg at field boundaries, road crossings, changes of direction). All affected landowners will be made aware of the exact location of the pipeline.

Alternative Techniques

Specialised techniques are sometimes used or needed to construct sections of pipelines where ground conditions are difficult or where there are challenging constraints e.g. river crossings, busy roads, bog etc. Trenchless techniques (e.g. directional drilling) have also been used successfully in Ireland to cross the River Boyne and Upper Shannon with gas transmission pipelines. Trenchless techniques can offer advantages of reduced impact during construction stage, but success is highly dependent on ground conditions which must be investigated in advance. To confirm the feasibility of specialised construction methods in the estuary areas, geophysical and geotechnical surveys will be carried out shortly.

machines – s in sequence



Installation of welded pipeline section using team of "side-boom" machines

Reinstatement on section of Gas Pipeline to the West in Co Galway

Operation and Maintenance

What Will Be In The Onshore Pipeline

The gas in the Corrib Gas Field is a very pure form of gas, consisting of approximately 97% methane/ethane. It is found together with small amounts of water and condensate (hydrocarbons in liquid form very similar to a light oil e.g. diesel/ kerosene). There is no significant difference between the heat or energy content (kcal/kg) of the gas that is transported in the Corrib onshore pipeline to the terminal and the gas which leaves the terminal and flows into the Bord Gáis gas transmission and distribution systems. This means that the gas in the Corrib onshore pipeline is just as safe as that in any Bord Gáis pipeline.

Pipeline Maintenance

The offshore and onshore sections of the pipeline are protected against internal and external corrosion. In order to prevent internal corrosion, inhibitor chemicals will be continuously injected into the pipeline at the gas well out at sea. The inhibitor will be pumped out to the gas well via a small pipe, known as an umbilical, linked to the terminal. Protection for the outside of the pipeline will be provided via a 3 layer polypropylene coating as well as a low voltage back up system. Monitoring tools and techniques will also be used to gather data on the internal and external condition of the pipe and to ensure integrity along its full length. These include pipeline inspection tools that are pushed through the pipeline. All inspection data will be reviewed by the operator and regulatory authority.

Methanol Injection

Methanol is added to the gas at the well. It acts as an anti-freeze and prevents the formation of small ice crystals known as Hydrates. The methanol is recovered at the terminal and is re-used back at the gas well - i.e. it is continuously recycled.

Leak Detection — Odorant

Odorant is added to natural gas as an effective means of alerting domestic consumers of leaks in appliances, for instance when a gas cooker in a kitchen does not burn but the gas is still flowing. In the case of Corrib gas, odorant is only added after the gas has been treated in the terminal as is done elsewhere in the world.

Leak Detection — Pressure Drop

Pressure, temperature and gas flow rates will be monitored on a continuous basis at the gas wells and the terminal. This allows a calculation to be carried out to account for all gas entering and leaving the pipeline and alerts the operator rapidly about any potential problems.

Pressure Limiting Valve

Mechanical design of the pressure limiting valve is in progress. In fact this will be a series of valves to provide protection against overpressure by quickly isolating the upstream pipeline. It will use a logic system to shut off the flow using a 'HIPPS' system (High Integrity Pipeline Protection System). The closure time for this valve will be less than one minute. Simply put, the Pressure Limiting Valve is a shut off system. It is not a pressure reduction device. It will be tested regularly to ensure that it is fully functional.

→ implications re IPPC application?

Sources of Further Information

If you would like to learn more about the Corrib Onshore Pipeline you may contact RPS at the following address:

RPS
Seafield House
Belmullet, Co. Mayo.
Phone: 097 20720 **Email:** ***routeinfo@rpsgroup.com***

Further information about the Corrib Gas pipeline can be found at the following websites:

Advantica Report
http://www.dcmnr.gov.ie/TAG/Technical+Advisory+Group.htm

Tag Report To Minister
http://www.dcmnr.gov.ie/TAG/Technical+Advisory+Group.htm

Peter Cassell Report
http://www.dcmnr.gov.ie/TAG/Technical+Advisory+Group.htm

Corrib Project
www.corribgas.ie

Centre For Public Enquiry Report
http://www.publicinquiry.ie/reports.php

Richard Kuperwicz Report
http://www.publicinquiry.ie/reports.php