From: Vince Loy <[redacted]>
Sent: Friday, April 26, 2024 9:50 PM
To: Viking CCS Pipeline <Vikingccspipeline@planninginspectorate.gov.uk>
Subject: Objection to the application Granting Development Consent for the Viking CCS Pipeline Project

You don't often get email from [redacted]

Tho whom it may concern
I have raised on numerous occasions with Harbour Energy and subsequently VIKING CCS serious concerns over the above application - at the original roadshow held in Theddlethorpe Village Hall I provided a set of questions and concerns to the "Expert" team present by their own addmision they had no answers and some of the items raised seemed to come as a surprise to them. This deeply concerns me that due diligence will not be carried out and that as the duty holder they felt that the subcontractor they will engage to run the plant at Immingham would ultimately be the responsible for regulatory compliance and liability, not their responsibility and Government (BEIS ?) would be responsible for auditing compliance is a very lacklustre and laissez-faire attitude in my opinion. I am an Oil and Gas professional with nearly 38 years in the industry so I am perhaps better informed than most and I object strenuously to this application being approved as there is no evidence that the concerns that have been raised (detailed below) have been adequately assessed , discussed and mitigated.

1) The Pipe line inventory at 53km and 84bar (1200psi) is circa 9858tons of CO2. 1 ton of CO2 is 556.2m3. The Block valves as per the latest map are spaced at 10.5km,10.5km,15.5km and final leg to Theddlethorpe is 16.5km - this means 1,953 tons CO2 between Immingham and block 1, also 1,953 tons between block 1 and block 2, between block 2 and block 3 = 2,883 tons CO2 and the final leg between block 3 and Theddlethorpe will have 3069 tons CO2. When converted into cubic meters at atmospheric pressure to make it easier to visualise these figures become as below 1953 tons becomes 1,086,258m3 2883 tons becomes 1,603,524m3 3069 tons becomes 1,706,977m3 - if broken down further each and every meter of pipeline contains 103m3 of CO2 and given the fatal concentration is accepted as 10% that becomes 1030m3 affected, CO2 is heavier than air so will not reach any great altitude so will spread further than it rises - I acknowledge that the above figures are based on no external influence by environmental or geological factors and assume a uniform expansion rate. If a breach/failure were to occur does VIKING CCS consider this volume of CO2 being released into the local population/environment to be acceptable and complies with reducing the risk to ALARP.

2) in the event an emergency depressurisation had to be conducted as per the above figures a significant volume of CO2 would have to be vented. A 25m stack will route to CO2 to an assumed "safe" height but you must agree is very much dependant upon metrological condition at the time of release i.e. if nil wind there will minimal to no dispersion and CO2 will sink to the ground level very quickly - CO2 when changing to gas phase cools to between -54 Celsius and -78 celsius - this will be significantly colder than the ambient temperature even on the coldest of winter days and is extremely likely to result in the formation of micro weather system at the vent/breach site whereby a convective downdraft will be formed and fed by the continued release /venting of CO2. As long as the downdraft air is denser (colder) than the environmental air at the same level, it will continue to

the downdraft air is denser (colder) than the environmental air at the same level, it will continue to accelerate. It will not decelerate until it becomes less dense (warmer) than the environment or until it begins to spread out in response to the surface. Couple with this the relative humidity at the breach site or venting site and it will rapidly cool the water droplets in the surrounding air causing potential carbonic acid hail/rain to form which will further exacerbate the downdraft potential not to mention the environmental and health related issues that will arise from acid hail/rain and the groundwater acidification due to increased CO2 at ground level, What has VIKING CCS done to mitigate this potential event specifically with regard to harm to human health and environmental impacts.

3) The process used in carbon capture utilises amines to scrub the CO2 from exhaust gases - it is then processed and the CO2 is captured dewatered and compressed/heated ready for transport, as part of the process Nitramines and Nitrosamines are produced - Permissible total concentrations of nitrosamines and nitramines proposed by Norwegian Institute of Public Health are 0.3 ng/ m3 in air and 4 ng/l in drinking water. According to WHO, Health Canada and U.S. EPA, the NDMA limit in drinking water are 100 ng/l and 0.7 ng/l respectively. In contrast to nitrosamines, data on chronic toxicity of aliphatic nitramines are very limited and there is not sufficient toxicological information for a proper evaluation of their health hazard. Although nitramines are less mutagenic and carcinogenic than their corresponding nitrosamines, they should also be considered as highly toxic. DMNA, N-diethylnitramine (DENA) and MNA should still be regarded as carcinogen of high potency. Many research on nitramines have shown their carcinogenic potential in animals The studies confirm the toxicity of some nitramines. Their results exhibited that amongst MEA-NO2, 2-nitramine-2-methylpropanol and nitropiperazine, only MEA-NO2 showed positive mutagenic effect. The other two nitramines were found not to be mutagenic. In turn, mutagenic potential of DMNA was not confirmed. To put into context 1ng is 1 billionth of a gram the recommended exposure is 0.3ng 1 grain of salt is approx 65,000ng therefore 1 grain of salt in an olympic sized swimming pool (25,000,000litres) is approximately 6 times the maximum recommended concentration of 0.3ng When asked how it would be monitored there was not a suitable answer given - it would be down to the contractor that was operating the site to manage. Not the answer I would have liked to hear from the Duty holder. What controls and mitigations are in place to prevent exposure and in the case of accidental release what Emergency response protocols will be implemented by VIKING CCS

4) Water within the Dense phase CO2 is likely to be in the range of 500ppm to 1500ppm and most probably towards the higher end of the range, if the water droplets are allowed to pool into free water then strong acids (specifically carbonic, sulphuric and nitric) can be formed which will react adversely with carbon steel and are likely to cause niche environment corrosion hotspots leading to rapid degradation of the internal surface of the pipeline and may result in localised failure at the corrosion site, H2S is also a byproduct of the combustion process (as well as sulphur dioxide, nitrogen dioxide, carbon monoxide and more) which is well know to cause embrittlement within carbon steel. A further concern regarding free water within the dense phase CO2 is clathrate hydrate formation which could cause further embrittlement and failure mechanisms. I note there are 12 area's within the current schematic of the pipeline where there are bends in the 70 - 90 degree range - will these be "cushioned" to prevent erosion and accelerated degradation of the pipeline. How will these concerns be addressed by VIKING CCS and integrity of the pipeline monitored.

5) Have lessons been learned and protocols implemented to prevent a similar occurrence with regards to the pipeline failure in Satartia, Mississippi February 22nd 2020, and more recent failure at the Exxon site in Louisiana 3 April 2024 - Still awaiting a response from VIKING CCS

6) Has VIKING CCS developed a robust safety case / Emergency Response Plan / Site specific

6) Has VIKING CCS developed a robust safety case / Emergency Response Plan / Site specific risk assessment and response plan / Environmental impact assessment and full assessment of impact on health, noise pollution, disruption, increased stress and inconvenience compensation with regards local residents within the catchment of the construction. Health Risk Assessment regarding increased low level exposure to CO2 and potential health issues arising from an increased background level of CO2 in both atmosphere, land and groundwater.

7) The age and design of the gas fields raises questions that should be addressed by VIKING CCS - Original casing design - are the casings in good condition, when were the last CBL/USIT (Cement bond log / UltraSonic Imager tool) logs conducted and did they confirm a homogenous competent cement - if H2S was produced with the natural gas there is a high probability of embrittlement/ corrosion. Is the cement suitable for CO2 sequestration - if water is present and strong acid formed the Portland cement can be adversely impacted. How successful was the original cementing, were remedial cement jobs required, deteriorated / inadequate cement bonding can provide micro annulus communication to surface.
How were the wells abandoned - will the wells require intervention/ work over prior to utilisation for sequestration. Competent risk assessment carried out to address lock up in the injection phase resulting in the pipeline becoming static and cooling to the point supercritical/ dense phase can no longer be maintained and CO2 returning to a gas phase

8) Have VIKING CCS conducted robust studies regarding micro seismology and earthquake propagation as a direct result of reservoir injection by dense phase fluids.

9) The cut is very close to the vent stack and the cut connects directly to the Great Eau river - there would be a high percentage risk that any slow/minor co2 leakage would go into solution in the cut raising the acidity as carbonic acid for sure and possibly Sulfuric or Nitric dependant on suitable chemical composition at the leak site - this would ultimately discharge into the Great Eau - Which has been classed as one of Lincolnshires best examples of chalk stream habitat as per Anglian water, Lincolnshire County Council, Environment agency, The Wildlife Trust, Wild Trout Trust, Lincolnshire Wolds and Natural England, with nearly £45,000 being spent in the maintenance and upkeep of the river What if any consideration has VIKING CCS given to protection of this habitat also there are numerous articles regarding the detriment that would be encountered if there was CO2 invasion into the groundwater system and subsequent acidisation which would effectively render the ground barren for all crops and livestock.

These are the main concerns that I have raised with VIKING CCS directly, and through the parish council with Victoria Atkins MP -Secretary of State for Health and Social Care
Also shown to Mrs Atkins was a video of the DNV test conducted at Spadeadam testing facility where an 8 inch pipeline 1km long was ruptured containing dense phase CO2 and the subsequent discharge and mass outflow recorded - apparently it had quite an effect on Mrs Atkins but there has been no subsequent support or communication from the Honourable MP I find this quite distressing given her role as Secretary of State for Health and Social Care.
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Kind Regards

Vince Loy
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