Dear Sir

This letter contains my comments on this application, which I would be grateful if you would take into account in your considerations. The letter extends to more than 1500 words and therefore I have included a less than 1500 word summary of my comments in Section One, with supporting details provided in Sections Two to Seven.

I would be grateful if you would confirm by email that you have received this letter.

Contents

Section 1       Summary
Section 2       General objections
Section 3       Sources of knowledge and information
Section 4       Principles of concern on specific risks
Section 5       Hazard from established rockhead flow paths.
Section 6       Hazard from established flow paths due to mine pumping
Section 7       Conclusions

Section one --- Summary

I wish to register my objection to the proposed application for the reasons listed in section two of this letter.
However, I would also wish to express my serious concern regarding a technical aspect of the application which I consider to present a high risk to the safety of the proposed development. This concern is regarding the potential effect of the historical salt field workings on the security of the storage caverns, which has not, in my view, been adequately investigated or evaluated by the Developer within the current application document.

In the report following the Public Inquiry into the previous Canatxx application, the Inspector Edward Simpson and the Assessor Ruth Allington commented on the Canatxx lack of understanding and inadequate investigation into the consequences of the historical salt workings on the gas storage proposal.

The current application document would appear to have attempted to remedy this deficiency by the inclusion of document reference 9.2.1-- Legacy Brinewell Impact Assessment (LBIA), prepared by Mott MacDonald.

This document focuses on the hazards of “Blow Out” and “Crown Hole Collapse” of existing brine well cavities, and provides details and measures to control only these two hazards. Whilst these two hazards are relevant they only affect the existing brinefield area and hence the proposed surface infrastructure such as pipelines, cables, buildings and roads. These two hazards are less relevant to the gas storage caverns which are intended to be located in areas anticipated by the Developer to be not affected by historical mining operations. However, there is evidence to suggest that the Developer has underestimated the potential detrimental effects of the historical mining operations in the areas where the caverns are planned.

The LBIA does not address the much more serious hazards of the consequences of the historical mining operations on the safety of the gas storage caverns themselves. There is data contained within the LBIA, and also in historical documents available to the Developer, which suggest the hazard of dissolution rockhead pathways existing in the areas where caverns are proposed, but these hazards have not been investigated or included in the risk assessment.

The possibility of voided rockhead pathways in the vicinity of the storage caverns presents the hazard of settlement damage to the cavern connection pipework, and preferential pathways for any gas which leaks from the caverns or pipe work to travel long distances with little resistance.

The hazards presented by preferential escape pathways resulting from the legacy of previous brine well pumping and dry mining are well known and have been responsible for increasing the consequences of escaping gas incidents in the USA (e.g. Hutchinson – Kansas State). An indication of the seriousness with which this hazard is regarded is the control measure implemented by the State Government which established exclusion zones preventing gas storage caverns from being positioned within 5 miles of an existing mine working, and 1 mile from an existing brine well.
The two aspects of the historical workings which could potentially present this hazard are the rockhead brine flows caused by the dry mining and operation of brinewells to the north of the saltfield, together with the subsequent operation of the abandoned mine as dissolution brinewell.

I provide detailed descriptions of these potential hazards later in this letter, but to summarise:--

Firstly, there is a possibility that the historical workings caused the development of rockhead brine runs which have then continued as wild brine runs and may continue to develop in the future, possibly in the areas of the gas storage caverns,

Secondly, the extent of the wet rock head pathways connected to the mine workings may be more extensive than the Developer’s interpretation and could extend into the area of the proposed caverns. This potential hazard is suggested by the system of pumping which was adopted when abandoned dry mine was operated as a dissolution cavity from 1941 to 1969,

In risk assessment terminology these hazards could be classified as “low likelihood” but extremely “high consequence”, and as such, need to be rigorously evaluated and appropriate control measures implemented. At this stage in the project, these would involve further desk study by interpretation of records and also physical ground investigation.

The basis for my concerns, and comments is my detailed interest in the history of the brine field over the last 50 years together with my knowledge as a Chartered Engineer experienced in underground construction work.

This proposal involves the storage of very large volumes of gas, at very high pressures in very close proximity to a large residential population and therefore the residual risk that the gas could escape from the caverns and migrate to the residential areas has to be virtually zero.

The safety of storage in unlined caverns relies on the suitability of natural geology of the site and on the fact that previous mining activities have not introduced additional risks. In the case of this application, I consider that neither of these factors have been sufficiently investigated and evaluated in order demonstrate that the risk factors are close to providing an acceptable level of safety.

Therefore this application should be rejected until further investigations have been carried out, and risk assessments completed to demonstrate that the proposal is safe. In view of the contents of the desk study information currently available, and the limited investigations already carried out, it is unlikely that further investigative work will ever be able to demonstrate that this proposal presents an acceptable level of residual risk to the safety of the public.
Section Two – General areas of concern relating to the application

Gas escaping from the caverns through the ground and igniting in or near to property due to:--
- Unsuitable geological conditions.
- Preferential pathways caused by previous mine workings, brine wells and other pipelines.
- Potential instability of the storage caverns caused by ground movements associated with previous mining operations.

Gas escaping into the atmosphere from failed pipelines, valves and compressor stations due to:--
- Ground movements caused by previous mine workings.
- Failures in quality of construction and maintenance procedures.
- Human error or computer control failure during operation of the plant.

The consequence of any gas escape would be exacerbated by the unreasonably close proximity of the installations to residential areas.
The emergency services would not have the capacity to cope with the consequences of a major incident.

The detrimental environmental impacts of the proposal on:—
- The coastal waters in the vicinity of the brine discharge outfall.
- All the land surrounding the installations.
- Local highways.
- The appearance of the rural landscape.

The detrimental effect of the installation on local amenities, tourism, property values and insurance premiums, particularly in the aftermath of any operational incident.

The possibility that, if this application based on reduced storage volumes compared with previous applications is approved, it will be followed by future applications to extend the installation with consequential further increase in risk to the surrounding area.

The potential stress and anxiety caused by residing in relatively close proximity to a high hazard installation with the likelihood of a major incident occurring.

The lack of experience and track record of the Developer as a company in the design, implementation and operation of gas storage projects, and their capability to manage an emergency, recently illustrated by the response to the blow out of Brinewell No 45.
Section Three  -- Sources of knowledge and information

I have lived in close proximity to the Preesall salt field for 50 years, during which time I have studied and collated information on the historical mining activities.

My knowledge of the historical operation of the Brinefield has been obtained by:--

- Conversations with ICI operatives when accompanying them on Brinefield maintenance work whilst I was a student.
- Conversations with active and retired ICI workers and managers.
- Collecting historical records from various sources

I am a Chartered Civil Engineer experienced in underground construction.

Section Four -- Principles of concern regarding consequences of historical mining operations.

Previous and current applications

I have studied the comments of the Inspector and the Assessor in their Report following the Public Inquiry into the previous application, with particular reference to their opinion that the Developer had not carried out sufficient investigations into the extent of the historical dissolution mining and dry rock salt mining in order to assess the implications on the safety of the current proposal.

The current application now includes more information on this aspect in 9.2.1 Legacy Brinewell Impact Assessment (LBIA), however, I am concerned that this latest assessment has failed to consider the potential hazard presented by rockhead pathways caused by the historical mining operations. I was anticipating that these hazards would have been considered by the Developer in the current application in order to fulfil the recommendations within the Inspector’s report from the previous Inquiry.

Wet rockhead

Due to the soluble nature of halite it is not unusual for the interface between the halite and the overlying mudstone to be voided or develop increased permeability due to the dissolving action of ground water, and is commonly described as “wet rockhead” or “rockhead dissolution”.

Wet rockhead can develop naturally due to hydraulic gradients caused by area differentials in natural ground water pressures. This process is often referred to as wild brine flow, and due to the low differential pressures which usually occur in nature, the development rate is slow.
However, “rockhead dissolution” can also occur on a larger scale, and at an accelerated rate due to the intentional or unintentional creation of significant hydraulic gradients by dissolution mining and dry mining operations. There is historical evidence of the extensive development of wet rockhead flow paths by both intentional and unintentional mechanisms during the operation of the Preesall Salt field.

There is actual evidence of the existence of some rockhead flow paths within the historical records which demonstrates the mechanism of development in the Preesall Salt Field. This mechanism could also be applied to the potential ground water differential pressures which could have been created by the reactivation of the flooded rock salt mine as a dissolution mine, which is described later.

Wet rockhead need not develop over a wide plane but can also develop in discrete, relatively narrow flow paths.

*The hazard presented by wet rockhead*

The risk is that a particular storage cavern could be created in an area which appears to have an impermeable rockhead, as shown from the coring of the central borehole to be used for “washing out” the cavern. However, there could be a permeable rockhead pathway in very close proximity to the cavern, but “just missed” by the central borehole. In the event that a gas escape route developed locally through a cavern wall due to the presence of a fault, discontinuity, or movement due to cyclic operational pressures, there may be only a very short distance of travel before the gas entered a rockhead pathway. The gas could then follow the line of least resistance over potentially long distances before reaching the surface, where it could present a varying level of risk dependant on the position infrastructure at the point of surfacing.

The cross sectional area of rockhead permeability, or voiding does not have to be large in order to facilitate the transmission of high volumes of escaping gas, and the reliable detection of such small voids would appear to be outside the capability of “Cross Hole Tomography” or other available geophysical ground investigation techniques at the depths involved. The only method of identifying wet rock head pathways would appear to be “cored” ground investigation boreholes, but this technique would not provide certainty in identifying discrete pathways, even if a large number of closely spaced boreholes were drilled.

The established method of controlling this risk is the imposition of an exclusion zone around existing mine workings and brine wells, within which, gas storage caverns shall not be constructed. In the State of Kansas, the consequences of serious gas migration incidents have been exacerbated by pathways created by previous mining operations. As a result, legislation has been enacted which requires an exclusion zone of 5 miles radius around an existing mine and a 1 mile radius around an existing brine well. If equivalent legislation was applied to the current proposal it would not be permitted to proceed.
The Developer’s proposals appear to recognise, to a limited extent, the safety risk presented by the close proximity of storage caverns to the existing mine cavity, by the defining of an exclusion zone to the west side of the mine, within which storage caverns will not be constructed. It is apparent that the intention of this exclusion zone is to control the risk that the perimeter of the existing mine cavity may extend further than shown on the historical record drawings, and that the Developer has been unable to confirm the actual extent of the mine by physical investigation.

It is of concern that the Developer’s proposal does not take into account the potential effects of the period when the flooded mine was operated as a dissolution cavity, which, on the basis of the known operating technique, could possibly have extended the permeable rockhead by significant distances into the areas outside of the limited exclusion zone, and where storage caverns are currently proposed to be sited.

The LBIA includes hazard assessments for “Crown hole development” and “Blow out failure” of existing dissolution cavities, but does not appear to assess the hazard of extended rockhead dissolution still occurring due to natural ground water differential pressures, nor does it assess the hazard of extended rock head flow paths caused by the operation of the flooded rock salt mine as a dissolution cavity over a 30 year period.

The LBIA does include data which suggests the existence of the above two hazards but does not progress to their identification or assessment of their implications, which could potentially have a more significant affect on the safety of the Development than the identified and assessed hazards of “crown hole collapse”, and existing brine well “blow out”.

Section Five -- History of the development of wet rockhead flow paths in the Preesall salt field, and relevance to the current application

The following description is relevant, in that it describes the well documented, man made development of a permeable rockhead flow path, which provides potential gas migration pathway 0.75 of a mile in length from the area of the mine to the Sherwood Sandstone on the east side of the Preesall fault adjacent to Park Lane. This point is within 0.25 of a mile of the centre of Preesall village and two schools.

The first element of this rockhead pathway was initially developed by the sinking of shaft No 2, following which the natural flow of ground water along the rockhead into the shaft was pumped from the shaft as a means of brine production. The position of shaft No 2 is shown on LBIA Figure A3, slightly to the east of the mine workings. Reference is made in the fourth line of Table A1 on page 32 of the LBIA to the natural brine connection along the rockhead between BH21 and shaft No 2, and that this connection eroded the rockhead resulting in the “5 acre flash” subsidence.
The production of brine at shaft No 2 was then improved by the sinking of BW 23 (in Acre Field) in 1890, down which fresh water was introduced to flow along the rockhead to be pumped from shaft No 2 as brine. (Thompson Report No 1, 1927 Page 9, and also the first line, “Acre Pit”, of Table A1 on page 32 of the LBIA)

This flow path increased further in length southwards and connected with the dry mine workings. In 1919 this brine began to enter the top mine through the roof, and the flow rate measured in the mine had developed to between 2000 and 5000 gals/hour by 1926 (Thompson Report on condition of mine roof 1929 Page 1)

This flow path then developed northwards to the area of BW No 54 (position shown on LBIA FigA1 and A3) where the surface subsidence caused by the rockhead brine was noted as extending towards BW no 54 (Thompson Report on The Failure of Forced Brine Wells at Preesall page 5). This is also referred to in BW 54, line 3 of Table A1 on page 32 of the LBIA.

It is relevant that the above report states that when BW No 54 was originally drilled in 1909 the rockhead was found to be secure and dry, but by 1922 the rockhead flow into the mine had caused the extension of the flow path northwards as far as BW no 54, when the brine well cavity became connected to the rockhead flow path. This demonstrates that where there is active rockhead brine flow in an area, a rockhead initially found to be dry, can subsequently become voided by extension of an existing pathway. This is particularly relevant to the situation where the central borehole for a storage cavern may initially show a dry, secure rockhead, but may develop into a voided rockhead during the operational life of the project.

It is considered that this rockhead connection then developed naturally eastwards from BW 54 to the east side of Park Lane where it connected with the Sherwood sandstone, on the east side of the Preesall Fault. Once this connection with the Sherwood Sandstone aquifer had been made, the substantial ground water feed from the sandstone continued to flow to the mine, and in so doing, enlarged the rockhead pathway. Ground level monitoring points were positioned by the United Alkali Co, or ICI in the area between BW 54 and the connection with the fault in order to monitor the effects of the increasing dissolution along the rockhead.

The rockhead flow path from the Preesall Fault to the area of BW 54 which has been referred to by saltfield workers, is evidenced by the presence of the surface settlement monitoring points referred to above which were positioned along the route and are shown on the plan in LBIA Appendix D page 70. The resolution of the electronic copy of this plan is not good, but appears to show surface levelling monitoring points along the flow path eastwards from BW 54 to Park Lane. There are no brine wells to the east of BW54 and therefore the only reason for the surface levelling points would be to monitor settlement resulting from the known rockhead brine path.
I recall from conversations with salt field workers that the results from surveys of these settlement monitoring points did show surface settlement and confirmed the predicted route across Park lane to the Preesall Fault.

The rockhead connection between the Sherwood sandstone and BW 54 is also referred to in a published account of the Preesall Salt Industry by local historian R Hogarth. This describes how the well pipes in BW 54 broke off above rockhead level due to rockhead erosion, thus preventing the brine from being pumped to the surface. It then says that a new borehole was instructed by Mine Manager F J Thompson to be drilled next to BW54 and fitted with an old fashioned beam pump. Mr Thompson is reported as saying, “A gallon pumped (intercepted) here is a gallon less in the mine”. I have not been able to find reference to this statement in F J Thompson’s own reports, but have no reason to doubt its authenticity or to doubt its confirmation of a significant rockhead flow path between the Preesall fault and the mine.

The rockhead flow path from the Sherwood Sandstone at the Preesall Fault through the area of BW54 and south to the mine was, at the peak of it’s development, caused by the differential between the natural ground water pressure on the rockhead at the Preesall Fault, and the atmospheric pressure within the dry mine.

However, since the flooding of the mine in 1930 it could be expected that the hydraulic gradient driving this flow path would no longer exist and that dissolution of the rockhead would cease as the static ground water on the rockhead became saturated brine. All solution brine wells in this area of the brine field had also been abandoned since the 1930’s which would be expected to have also removed the possibility of a dissolution mining induced hydraulic gradient along the rockhead.

It is therefore very relevant that ICI continued ground level monitoring of the settlement along this flow path until at least 1989, indicating that they possibly believed that the flow path had remained active under natural rather than man made differential heads.

The LBIA plan in appendix D page 70 (poor resolution E Copy) previously referred to, appears to show the settlement points along this flow path coloured pink, which according to the key, indicates cumulative surface settlement in the range of 10 to 20mm being measured between 1964 and 1989. If this is correct, it could be relevant that surface settlement is still occurring above this pathway, over 50 years since the cessation mining, and the removal of man made hydraulic gradients.

This could be a indication that natural ground water levels have not returned to the static pre mining state, and that the flow of ground water along the rockhead from the Preesall fault into the heart of the brinefield is still taking place today under naturally occurring differential heads of ground water.

The safety implications of continued wild brine dissolution of the rockhead occurring in close proximity to a gas storage installation are very significant, and should merit further investigation and evaluation before approval of this scheme is considered further.
Section Six – History of operating the mine as a dissolution cavity and relevance to the current application.

History of the operation of the mine as a dissolution cavity

In the early stages of World War two, in response to the urgent need for increased brine production it was decided to convert the abandoned flooded mine into a dissolution cavity. This fact is confirmed by Figure A3 on page 30 of the LBIA which identifies WW2 on the timeline and identifies the drilling of Mine wells Nos MW 1 to MW 8 in 1940.

The positions of Mine Wells Nos 1 to 8 are shown on LBIA plan fig A1 appendix 1 page 26

There would appear to be little written information on the conversion of the flooded mine to operation as a very large dissolution cavity but there was, of necessity, a fundamental difference between the method of operation of the mine and a conventional brine cavity.

A conventional dissolution well is a sealed system and the pressure of the fresh water pumped into the cavity is utilised to cause the brine to flow up from the cavity, and then to the discharge booster pumping station. This method of operation provides a guarantee that the fluid pressure within the cavity is always in excess of external ground water pressure, thus negating the possibility of natural ground water flow along the rockhead into the cavity.

The reason for establishing and evaluating the unconventional method of operation of the mine as a dissolution cavity is to assess the likelihood that the method caused the development of rockhead flow paths potentially radiating outside the perimeter of the dry mined cavities.

However, the possible existence of any such flow paths could potentially present a much more significant risk in the context of an underground gas storage project.

As student during the late 1960’s, I remember being shown an installation by salt field workers who described it as the headworks for a pump which was pumping brine up out of the mine. The pump being fixed to the lower end of a vertical steel discharge pipe located within an outer bored casing. The pump was said to be positioned at a level within the mine cavity and the headworks included a fixed derrick which was used to raise the discharge pipes and bring the pump to the surface for maintenance. I recall that this pump headworks was probably in the position of MW 7 shown on the brinewell location plan in the LBIA. As recently as 2007 the top of a large diameter casing was still visible in the vicinity of MW No 7.
This independent submersible pumping arrangement would suggest that the mine was not operated as a conventional forced brine well.

This suggestion was subsequently confirmed by the content of ICI engineering record drawing No UVW 98384 dated 26/2/51 and titled Brine and Well Water Transfers – Preesall to Hill House. The pipeline layout on this drawing clearly shows two independent fresh water feeds from Number 5 pumping station, one to the Brine Wells and the other to the Mine. The feed to the brine wells is labelled high pressure, but significantly the feed to the mine is labelled low pressure. The low pressure feed to the mine would not have sufficient pressure to force the brine back up to the surface. The drawing also shows separate brine discharge mains from the mine and the brine wells.

It is not clear where the low pressure fresh water was fed into the mine, however, I recall that there was no visible pipework leading to the caps of shafts No 3 and 4 which were unfenced and accessible during the period when brine pumping from the mine was taking place. Therefore it is possible that not all of the 8 boreholes MW1 to MW8 were used for extract pumping and some may have actually been used for the input of fresh water.

The decision not to operate the mine as a conventional “forced” brine cavity is understandable due to the knowledge at the time that the mine would not be able to contain a pressure head above ground level, which would be sufficient to allow the input pressure to drive the discharge flow.

The potential routes of pressure leakage from the mine, which may have been taken into account at the time, could have been:--

- The existence of the 1.8metre diameter access shafts No 3 and 4 into the mine, which would require to be securely sealed to withstand the return pressure.

- The existence of the known rock head connection from the north, which brought ground water flow into the mine and caused its abandonment.

- The existence of the crown hole subsidence, known as the Mine Subsidence, which is thought to have been influenced by the presence of BW 24 cavity which was very close to the mine cavity. It is also thought that this subsidence may have retained an open connection with the mine cavity, due to the fact that the water in the subsidence has maintained a brine content, in contrast with the fresh water content of the other crown hole subsidences in the vicinity.

- The existence of the crown hole subsidence, at the north end of the 5 Acre flash, which was caused by a substantial roof fall into the mine. (Reference the 1929 Thompson report on the condition of the mine roof).

*The potential consequences of operation of the mine as a non pressurised dissolution cavity*
The halite/mudstone rockhead interface at the mine is in the order of 100m below the level of the tops of shafts 3 and 4 which are on the shoulder of the drumlin. Assuming the natural ground water level in the area to be close to surface level, the likely natural ground water pressure at rockhead would be in the order of 9 bar. This is the pressure which would need to be sustained at rockhead level above the mine in order to prevent the development of a hydraulic gradient and consequent flow of ground water along the rockhead and into the mine cavity.

There is much evidence of connections between the rock head just above the mine cavity and the cavity itself, which is provided in the Thompson reports on the collapse of the mine roof, and the account of the wild brine from the area of BW54 flowing into the mine.

To avoid the development of a hydraulic gradient during pumping from the mine, the water level in the mine shafts would need to be maintained at natural ground water level, say 10m below ground surface. This balance would be extremely difficult to achieve with the pumping system that was used, because the pumped flow rate of fresh water input to the mine would have to balance the output of the independent submerged pumps in the mine cavity. It is possible that some form of automatic level control system may have been used but this is thought unlikely.

The two shafts were lined with 1.8m diameter cast iron tubing providing a combined volume of 5 cubic metres per metre depth, and assuming that the 8 mine wells were 450mm diameter they would provide a combined volume of 1 cubic metre per metre depth.

It is not known what controls were in place to balance the input and output volumes of water and brine, however, due to the small cross sectional areas of the shafts and mine wells a relatively small imbalance between input and output could have a disproportionately large effect on the static water head at rockhead level. A shortfall of only 500 cubic metres of input water would reduce the level in the shafts down to rockhead level and completely remove any pressure to prevent natural flow along the rockhead into the mine.

If, in the reverse situation, where input volumes may have exceeded the output volume from the submerged pumps, then it would only require an excess input volume of less than 50 cubic metres to raise the level in the shafts from natural ground water level to ground surface level resulting in the overflow brine out of which ever shaft or mine well was situated at the lowest ground level.

Therefore, possible consequences of an overflow situation would have provided a strong incentive for the system to be operated with the static water level in the mine at a level some way below natural ground water level. This form of operation has the potential to create a hydraulic gradient which could induce natural ground water flow along the rockhead into the mine cavity.
The concern is that natural ground water flow along the rockhead would cause the development of dissolution pathways in a similar manner to “wild brine” flow paths.

The fact that the mine could have been operated in this way for nearly 30 years between 1941 and 1969, introduces the possibility that, even small hydraulic gradients over a long period, could have caused the development of extensive dissolution pathways up to considerable distances from the original mine perimeter. These pathways could extend into the areas planned for gas storage caverns and generate the risks previously described.

The operating Company at the time may have been aware of this possibility, but, considered it of low consequence, because the relatively low volumes of dissolution over a wide area were unlikely to result in significant surface settlement, in what was predominantly an agricultural area. In fact, the relatively low additional brine flow into the mine may have been welcomed.

There is a possible link between the operation of the mine as a solution cavity up until 1969 and the surface settlement recorded on the level monitoring points between BW54 and Park Lane, which is recorded on the plan in Appendix D on page 70 of the LBIA.

This may provide an answer to the question of why ICI continued to monitor the surface levels above the established rockhead brine flow path between BW54 and Park Lane as recently as 1989. It could have been expected that the man made hydraulic gradient causing the flow would have been negated in 1930 when the mine was abandoned and allowed to flood, together with the abandonment of the forced brine wells in that area of the salt field during the 1930’s.

The answer could simply be that ICI accepted that their selected method of operation would not provide a balance of ground water pressures on the rockhead and would carry the risk of inducing rockhead flow into the mine. Therefore, they may have elected to continue ground surface level monitoring along the route of the previously established rockhead flow path, via BW54, up to the Sherwood Sandstone east of Park Lane.

The plan on page 70 of the LBIA records a surface settlement of between 10 and 20mm along this flow path from 1964 to 1989. It is possible that this settlement has occurred as a result of further dissolution along the pathway due to a hydraulic gradient created by the lack of ground water pressure balance during the period of brine pumping from the mine.

Section Seven -- Conclusions
The Developer’s Legacy Brinefield Impact Assessment does not appear to address two of the most significant hazards which are presented to the safe construction and operation of the proposed gas storage caverns, even though the data included within the assessment could suggest that these hazards are present.

These are significant hazards which may not be able to be physically investigated to an appropriate level of confidence from which a risk assessment could be carried out and control measures implemented.

The potential existence of continuing rock head brine flow in the vicinity of the area of the proposed underground gas storage caverns presents a very significant hazard to the safety of the installation, and therefore the possibility requires rigorous investigation and assessment before the application can be considered for approval.

The existence of these hazards is typical of those known to be associated with old mine workings in the proximity to proposed underground gas storage caverns. This hazard has been controlled in the USA by the implementation of a 5 mile exclusion zone.

In view of the uncertain geology in the area, the presence of a population of 100,000 within three miles of the proposed site, and the potential hazards detailed above, this proposal cannot be considered to be safe, and therefore it would be appropriate that the application be rejected.

Yours Sincerely

P J Moore