Summary of Representation

to

The Planning Inspectorate
National Infrastructure Directorate

by

D.S., M.J & R.S Jackson

May 2012

Preesall Saltfield Underground Gas Storage
Application – IPC Reference No EN030001
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Response to Development Consent Order request by Halite Energy Group Ltd. - Reference No. EN030001.
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Preesall Saltfield Underground Gas Storage Application – IPC Reference No EN030001
Height O’th Hill and Little Height O’th Hill on the Wyre Estuary 25.06.09

Front cover photograph by courtesy of Walter McCann, the village of Preesall viewed from the Northfield subsidence. Aerial photographs supplied by RJS AP Vintage Ltd.
1. INTRODUCTION

1.1.1 My name is June Jackson, I am a partner in a farming and engineering business trading as D. S. Jackson. The other partners being my husband Darrell and son Richard.

1.1.2 My husband holds the tenancy of agricultural holding no 21/163/003, in the parish of Stalmine with Staynall, comprising part of Gaskells Farm, Staynall, since 1971, Little Height O' th Hill Farm, Stalmine, since 1972 and Height O' th Hill Farm, Stalmine, since 1984.

1.1.3 [Redacted] became tenant of Height O' th Hill Farm in 1959, my husband has been a resident for 52 years and I have been a resident since 1970.

1.1.4 My son Richard and his family occupy Little Height O' th Hill.

1.1.5 Part of the holding comprises an area of the former Agglbys Farm, which was held in the tenancy of my [Redacted] prior to the demolition of Agglby's farmhouse and associated buildings, due to the danger of subsidence.

1.1.6 Since 1985 my husband has been employed as a sub-contractor on the Preesall brinefield, as he was able to supply a JCB at short notice and had engineering experience, which ICI Chemicals and Polymers Ltd found very convenient during drilling operations and other brine field related incidents or fractures of the main brine pipeline, which supplied the Hillhouse complex.

1.1.7 During and after de-commissioning of the brine field, he assisted in safety work, for example sonar surveys, employed originally by ICI and currently by Thornton Business Facilities Management, on behalf of NPL Estates.

1.1.8 At the Public Inquiry 2005/2006 into the previous Canatxx Gas Storage application\(^1\) and HSC application\(^2\), I submitted evidence on the mining and site development history on behalf of my husband. Mr Humphries QC, the lead Canatxx barrister, declined to cross examine me on this evidence, stating that "Mrs. Jackson's evidence is factual."

1.1.9 As Halite in their current Development Consent Order (DCO) application\(^3\) acknowledge that their new proposals are similar to the previous planning application proposals, I believe that my evidence is still relevant.

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\(^1\) APP/02371/A/05/183798
\(^2\) APP/HSC/05/07
\(^3\) EN030001
2. INADEQUATE AND INACCURATE PLANNING INFORMATION HAS BEEN SUBMITTED BY THE DEVELOPER.

2.1.1 The developer’s plans rather than being based on thorough survey work of the development area, taking into account present, past and predicted future local conditions, appear to have been drawn and redrawn repeatedly because of a lack of any real basic local knowledge.

2.1.2 The E. I. A. Statement and Planning documents show an inadequate knowledge of the previous mining history of the area, contaminated land issues and natural and man-made features.

2.1.3 The developer has failed to take into consideration the risk of gas migration and to carry out adequate risk assessments. There is insufficient information available to properly assess whether this is an acceptable location for this type of development to provide justification for affecting the rights of others.

2.1.4 Halite state that the Preesall Salt Field is ideally suited for gas storage(4). This claim is not supported by the British Geological Survey (BGS) reports(5), included in the Supplementary Environmental Information in the previous gas storage application. The BGS have made it very clear that they are not able to comment on the quality or suitability of the salt for gas storage.

2.1.5 The developer has failed to submit an adequate decommissioning programme or supply details of measures to be undertaken to mitigate long-term subsidence. Decommissioning plans are “uncertain.”

2.1.6 In my opinion planning permission for a development of this magnitude should not be granted on a conceptual idea, the onus is on the developer to prove that the development is practical and realistic and is not harmful to the local population and the environment.

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(4) Halite Project Overview.
3. GEOLOGY

3.1.1 Approximately 90% of global underground storage facilities are in depleted oil and gas fields or aquifers. Salt cavern storage contributes approximately 10% of capacity and yet, from the reported incidents salt cavern storage appears to be the environment in which the most gas escapes/leaks occur(6).

3.1.2 Salt cavern gas storage poses substantially different development and operational risks than depleted reservoir storage.

3.1.3 Most of the current geological information is based on a reappraisal of existing data. Some work was undertaken at Hay Nook test borehole, which is outside the areas designated for the creation of natural gas storage caverns.

3.1.4 The Technical Assessor in her report following the Inquiry drew attention to the requirement for further geological investigation:

"The primary constraints on the number, location, preliminary design of the caverns and scheme capacity at this site are thickness; depth and inclination of the salt bed; and the location and nature of faults."(7)

"Given the fundamental importance of the geological structure of this scheme, it is surprising that evaluation effort has not been more focused in these areas in the form of a site investigation."(7)

3.1.5 The required site investigation recommended by the Assessor of at least two more seismic survey lines and the drilling of and logging of boreholes along those survey lines has not been undertaken.

(7) Report by technical assessor, Ruth Allington BSc  MSc MBA FIMMM CEng FGS CGeo MAE QDR on geological, hydrological and cavern stability issues relevant to the consideration of the application by Canabxx Gas Storage Limited to develop and operate gas storage caverns at Preesall, Lancashire, 7th March 07.
3.1.6 At the time of the last proposed brine well development, in 1991, I.C.I assumed that the salt became deeper and thicker towards the river, Brine Wells 135 and 136 were planned at the Heads, as part of the on going brine field development.

Brine Well 135 November 1991

3.1.7 On the 25 January 1992, the boring of 135 was completed. Top of salt was expected to be at 270 metres and the salt was expected to be about 250 metres thick.

3.1.8 Results were not as expected, the depth to top of salt was 247m, the salt was found to be only 169m thick, the quality of the salt was also disappointing.

3.1.9 Subsequent tests, confirmed the results from 135(8), no further wells were drilled, brine production ceased and much of the Hillhouse complex, which had been reliant on brine as a feedstock, closed down.

3.1.10 The Preesall Salt Field had always been geologically characterised as a syncline. It is now thought to be a down faulted graben lying between two major faults the Preesall fault in the east and the Burn Naze fault in the west. In layman's terms a syncline is a downfold in strata forming a basin, a graben is strata dislocated by faulting to form a basin.

3.1.11 The Preesall fault is well documented and can in some areas, to the east of Park Lane, be seen projected to the surface.

3.1.12 The Burn Naze fault is thought likely to be under the Wyre Estuary.

(8) W.A. Longley-Cooke ICI Engineering, letter dated 03 July 92 and accompanying drilling log BW 135.
3.1.13 As the geological structure has been reinterpreted and is now assumed to be a graben, it is more likely than not that more faulting will be found when a more detailed investigation is carried out.

APPENDIX A
REPORT BY THE TECHNICAL ASSESSOR

3.26 Sketches from Assessor's notes illustrating the key features of a syncline and a graben

Sketches from Assessor's notes illustrating the key features of a syncline and a graben(9).

3.1.14 Dr. David Evans (BGS) comments in HSE RR 605:

"Over much of the workable salt beds onshore in the UK (mostly the Cheshire Basin, but including Wyre in Lancashire) exposure of the rocks at surface is poor, with thick glacial drift deposits blanketing the bedrock (solid) geology. A lack of exposure and also subsurface information in terms of boreholes and/or seismic reflection, mean that surface geology is not therefore well constrained. It is possible that site characterisation (subsurface mapping ect. using high resolution seismic reflection data for example) may not yet have been adequately undertaken and that possible faulting of an area is as yet poorly constrained or even unrecognised."(10)

3.1.15 At the Wyre Community Group meeting, 09.05.11, Halite confirmed that the deviated test bore at Barnaby Sands (mis-named Burrows Marsh by Halite) did not identify the location of the Burn Naze fault.

(9) Report by technical assessor, Ruth Allington BSc MSc MBA FIMMM CEng FGSS CGeol MAE QDR on geological, hydrological and cavern stability issues relevant to the consideration of the application by Canatxx Gas Storage Limited to develop and operate gas storage caverns at Pressail, Lancashire, 7th March 07.
Presumed location of the Burn Naze fault

3.1.16 Over large areas of the site, where proposed cavern locations have been indicated, there is no information whatever about the location or nature of the faults (11).

(11) Report by technical assessor, Ruth Allington BSc MSc MBA FIMMM CEng FGS CGeol MAE QDR on geological, hydrological and cavern stability issues relevant to the consideration of the application by Canalux Gas Storage Limited to develop and operate gas storage caverns at Preesall, Lancashire, 7th March 07.
4. MINING AND DEVELOPMENT SITE HISTORY

4.1.1 Preesall Brine Field History

4.1.2 In 1872, while searching for iron ore, a syndicate of men from Barrow, struck a bed of rock salt about 400ft below the surface in Preesall.

4.2.1 Wild Brine

4.2.2 Natural brine was found in the north-east area of the salt field and wild brine pumping started by sinking shafts and borings into the salt.

4.2.3 Natural brine occurs where a source of water has access to a salt deposit. Wild brine can be produced at depth where salt beds have been thrown against water bearing formations (e.g. sandstone) by a large fault, as occurs at Preesall.

4.2.4 Solution may take place at some distance from the borehole. The origin of the wild brine from a particular borehole cannot be determined, although the position of subsidences indicates where at least some of the solution is taking place.

4.2.5 At Preesall attempts were made to augment the natural supplies by feeding water into the salt in borings and allowing the brine, so formed, to pass along the top of the salt to the shaft, from which it was pumped(12)

4.2.6 A form of induced uncontrolled brining occurred during World War II when brine was extracted from the former conventional mine workings, in order to accommodate the increased demand for the chemical feedstuff.

4.2.7 As late as 1961, it was decided that brine should once again be extracted from the mine site, despite concerns over further solution in the bottom workings(13).

4.2.8 No documentation on the amount of salt extracted by solution mining of the conventional mine site has been made available and no adequate investigations into the extent or condition of the mine site have been undertaken.

(12) ICI Chemical Industries Mond Division document Controlled Brine Pumping at Preesall, explaining wild brine pumping.
4.3.1 Conventional Mining and Solution Mining

4.3.2 In 1883 the Fleetwood Salt Company was formed and six years later they bought 22 acres of Burn Naze salt marsh and re-claimed it for construction of a salt works.

4.3.3 Mineral leases were secured in 1886 and in 1890 the company was acquired by the United Akali Company.

4.3.4 In 1893 mining of the rock salt commenced. Two levels of mines were created, one at a depth of 450ft and a second in 1904, at a depth of 900ft. The salt was taken to the surface in tubs.

Preesall Salt Mines
The workers in the foreground can be seen filling tubs with rock salt.
Preeceall Salt Mines

Mine Head Buildings
4.3.5 In 1889, on the Thornton side of the river the Preston and Wyre Railway Company had agreed to put in a sidings and haul salt to Fleetwood Dock. By 1891, approximately six ships a month were sailing from Fleetwood carrying salt.

4.3.6 On the Preesall side of the estuary a spur of the Knott End – Garstang Railway was constructed and a jetty on the Wyre Estuary at Preesall.

Preesall Jetty

Preesall Jetty, Preesall salt was exported worldwide.
4.3.7 Solution mining was being carried out concurrently with the conventional rock salt mining. Frederick Thompson, of the well-known Cheshire salt mining family, helped develop the principles of modern solution mining at Preesall\(^{(14)}\).

Early Solution Mining Infrastructure.

Brine Wells on the Preesall Salt Field

\(^{(14)}\) A guide to the Lion Salt Works, Marston – The Thompson Family.
Unfortunately both “dry” mines extended into the area covered by natural brine. Water seepage occurred, by 1923 it became obvious that the problem could not be controlled. The mines became flooded and were closed in 1930. I.C.I. took over the United Alkali Company shortly before the closure of the mines.

Sketch map showing approximate areas of conventional mine workings.
4.4.1 Subsidence

4.4.2 Within a matter of years of the commencement of solution mining, subsidence occurred, borehole 23, Acre Pit 1891, brine wells 28 and 29, Northfield 1901 and BW 54 Westfield 1923. The Westfield subsidence necessitated the demolition of Westfield farmhouse and buildings because of their proximity to the subsidence.

Westfield Farmhouse, Acres Lane, Preesall, 1923 prior to demolition, as a result of the subsidence of BW 54.

4.4.3 In 1930 BW 21 to the north of the mine site, the Flash collapsed, followed by the Mine subsidence in 1934. Subsidence occurred to the west of Ivy Cottages BW 48, Back Lane in 1965, followed by the collapse of BW 52, Agglebys in 1974. Once again a farmhouse and buildings had to be demolished. The tenant farmer was...

4.4.4 Aggleby’s subsidence is still expanding, the security fencing has been relocated and extended on several occasions. Aggleby’s Road has subsided and been closed{15}.

{15} Letter Colin Nield, ICI Chemicals & Polymers, 14 April 1997 advising of the subsidence and closure of Aggleby’s Road.
Aggleby's Subsidence September 2005

4.4.5 Footpath 39, Preesall and footpath 14 Stalmine with Staynall, crossed this area of subsidence and have been subject to an extinguishment order by LCC. It is a matter of record that the Environment Director and the applicant (Canatxx) had considered possible alternative routes around the collapsed well but unfortunately no safe alternative had been found.

4.4.6 The OS maps and aerial photographs which Halite are using in support of their application, do not accurately depict the extent of present subsidence.

4.4.7 Halite depict Aggleby's and other areas of subsidence as ponds in their planning application.

4.4.8 At BW 52, the depth sounding bathymetric survey 1997, shows that there is at least 60m of water with the maximum depth recorded of 90m, clearly not a "field pond".

(16) 1:2500 OS Sheet No SD 3545, map reference 8688.
(17) Highways Act 1980 – Section 118.
(18) Minutes of the LCC Regulatory Committee, 26.10.2005.
4.4.9 The most recent subsidence was BW 88 at Height O'th Hill farm(21). A series of 8 photographs illustrating the progressive subsidence of 88 are provided. The subsidence was unexpected, hence it's unfenced state.

1. BW 88 Subsidence 25.5.94.
   Top left Burrows Hill, top middle and right Burrows Marsh SSSI and Hillhouse International.

2. BW 88 Subsidence 25.5.94
   Top left Park Lane, Preesall.

(21) Series of 8 photographs illustrating the progressive subsidence of BW88, 1:2500 OS Sheet No SD 3545, map reference 8545.
3. BW 88 Subsidence 25.5.94
   Top left The Grange, Stalmine.

4. BW 88 Subsidence 25.5.94
   Top left Height O'th Hill, top middle Little Height O'th Hill, top right Burrows Hill.
BW 88 Subsidence 12.7.94.
Top right The Grange

See group of three people for scale

BW 88 Subsidence September 2002
Right of centre three people showing scale of subsidence.

(22) Photograph by courtesy of Ian Mulroy.
Top left Fleetwood.

8. BW 88 Subsidence 06.01.2010.
Middle right, example of brinefield service infrastructure fractured by catastrophic collapse.
4.5.1 I.C.I. Mond Division and I.C.I. Chemicals & Polymers Ltd – Solution Mining

4.5.2 Salt in the form of brine was used as a chemical feed stock by the Hillhouse Site at Thornton for the production of chlorine, caustic soda and soda ash.

A modern brine well at Stalmine, 19.07.91.

4.5.3 Brine bursts and ground contamination have occurred whilst the Preesall brine field was operational.

Example of brine burst, Aggelby's Pasture 18.05.92.
4.5.4 Ruth Allington, the Assessor at the Public Inquiry made it clear in her report;

"The continued security of these caverns depends upon the continued integrity of the well string and valves at the well heads" (23).

4.5.5 In the summer of 2009, a serious brine burst occurred at BW 43, New Heys Farm. The cause was corrosion of the well head. In this case Canatxx denied any responsibility but if this lack of maintenance continues throughout the brinefield, this will become a serious environmental problem.

4.5.6 A rolling program of maintenance, safety work and monitoring of the condition of the brine field was undertaken, formerly by ICI and subsequently by NPL Estates. This was discontinued by Canatxx Gas Storage Ltd.

4.5.7 When the brine field was operational and, following it's de-commissioning, regular surface levelling was carried out across the brine field and the caverns were regularly "dipped and hooked" to check the condition of the cavern roofs and at risk wells were sonar surveyed.

4.5.8 My husband, Darrell carried out the last full "dipping and hooking" survey in 2005.

4.5.9 In particular, it was considered important to monitor brine wells with marl roofs, to detect the location of the cavities in relation to the surface, in order that safety measures could be put in place prior to catastrophic collapse.

4.5.10 Three methods of monitoring were used:

i. Each brine well is surrounded by a network of levelling points. The results from the current survey were compared with previous surveys, so that a general indication of the level of subsidence throughout the brine field could be obtained.

ii. In order to assess any movements within the cavities, ICI came up with an assessment known as "dipping and hooking". This activity uses a "claw" on the end of a measuring rope, this claw is dropped into the underground void until solid ground is reached at the base of the cavern "dipping". As the claw is raised again it is opened so that it will catch on the roof of the cavern to assess the depth from surface to void "hooking" (24).

iii. Sonar surveys give an accurate picture of the size and shape of the salt cavern.

(23) Report by technical assessor, Ruth Allington BSc MSc MBA FIMMM CEng FGS CGeol MAE QDR on geological, hydrological and cavern stability issues relevant to the consideration of the application by Canatxx Gas Storage Limited to develop and operate gas storage caverns at Pressall, Lancashire, 7th March 07.
ECHO - LOG

PREESALL 118

1. survey

13.11.2003  031 618

4.5.11 A sonar survey was proposed by Canatxx of 22 wells in the vicinity of the river bank during November 2003. Results were incomplete. Those wells previously considered most at risk were not included in the Canatxx survey. There are presently 25 brine wells with marl roofs.

4.5.12 The Executive Summary of HSE Research Report RR671 recommends that:

- abandoned wells, in and around the storage area, must be accurately located and previous completions checked out for integrity and gas tightness.

4.5.13 Dr. David Evans, BGS, submitted a report in the Canatxx Supplementary Environmental Information, advising of the need for a full survey of the Preshall salt field:
6. Suggestions for future work

“To assess fully the size and stability of caverns with marl roofs and those of neighbouring caverns, via a full sonar survey of all accessible brine wells, if possible.”

4.5.14 A level survey of all existing well heads at Preshall was proposed by Canatxx for the weekend of 5th/6th September 2009.

The value of this survey remains to be seen, as the existing levelling points were not used. Some of the levelling points from the northern area of the brinefield have been removed.

4.5.15 Four brine wells have been fenced off as subsidence is considered to be imminent, 50, 64, 89 and 97.

4.5.16 The 2002/2003 survey of wells indicates:

**BW 50.** The overall trend of this cavity at present is to surface. With the continued deterioration of the roof, the likelihood of a total collapse is very probable and fencing off the area is recommended. Recommend annual monitoring as with all cavities with the roof level so close to the surface.

4.5.17 BW 50 is situated in the vicinity of the proposed security entrance and support facilities at Higher Lickow Farm.

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(25) List of Brine wells (marl roofs) Preshall Brinefield, Survey of Obsolete Wells, Graham Veal, Ineos Chlor Limited, 02/05/02. Numbers 31, 32, 43, 44, 46, 50, 59, 63, 64, 65, 69, 70, 73, 74, 76, 81, 83, 84, 87, 89, 92, 93, 94, 97 and 98.
(26) HSE Research Report RR671 Failure rates for underground gas storage, 2008
(27) BGS CR/08/14 Review of Canatxx work relationship to mining in the Preshall Saltfield and comments on wet rockhead conditions.
(29) Preshall Brinefield, NPL Hillhouse Survey of Wells, 2002 and 2003
4.5.18 The Ineos Chlor 2001 Preesall Site Survey, Dipping and Hooking Report expresses concern in regard to Higher Lickow Farm.

"Consideration must be taken into account of the farmhouse in the vicinity as a collapse will significantly affect the property." (30)

Higher Lickow Farm buildings damage caused following Halite vibroseis survey.

4.5.19 In Halite’s Environmental Statement it is stated that the Higher Lickow farmhouse and buildings would provide an ideal location for a Security and Support Facility. (31)

4.5.20 Halite are ignoring the high level of risk by siting training, health and safety accommodation, staff facilities, offices, a locker room, toilets, a canteen and maintenance workshop and parking for employees and visitors at this location.

(30) Ineos Chlor 2001 Preesall Site Survey Dipping and Hooking Report, Graham Veal 02/05/02
4.5.21 The 2002/2003 survey BW 64

When compared to historic readings it becomes clear that the level of the roof within the well has steadily risen by 30.8m over the 18 years of monitoring and the level of the floor within the well has also steadily risen by 52 metres. The 2001 report indicates that this cavity is trending towards the surface, this would appear to be still the case(32).

4.5.22 BW 64 was one of the brine wells surveyed by passive microseismic monitoring in 2000. The system was in place for 3 months, during which 74 seismic events were recorded(33).

4.5.23 BW 64 is in close proximity to a bridge which crosses the Grange Pool Watercourse, this route is in daily use by Halite security personnel.

4.5.24 Ruth Allington, the technical assessor at the Public Inquiry states in her report;

"Canatxx have not identified the former salt mine workings on its maps and figures and appears not to have considered the potential impacts on surface and sub-surface infrastructure associated with these former mine workings, or the brine caverns"(34).

(33) Passive Micoseismic Monitoring at the Presseall Brine Field, Mike Branston BSc, PhD, FGS – Geophysicist.
(34) Report by technical assessor, Ruth Allington BSc MSc MBA FIMMM CEng FGS CGeol MAE QDR on geological, hydrological and cavern stability issues relevant to the consideration of the application by Canatxx Gas Storage Limited to develop and operate gas storage caverns at Presseall, Lancashire, 7th March 07.
4.5.25 Canatxx include in their Supplementary Environmental Information, a report by Dr. David Evans of the British Geological Survey. The report raises the issue of safe location of major infrastructure;

"The proposed siting of major infrastructure should take into account the locations of existing brine caverns within the worked area of the Preesall Saltfield in order to avoid possible damage to infrastructure, and maintain safe operation of the storage facility" (35)

4.5.26 Halite have located access roads, gas infrastructure and services in the vicinity of existing brine wells.

BW 89, in the foreground, fenced off as subsidence is imminent and BW 48, Ivy cottages subsidence, top left.

4.5.27 According to the appraisal submitted in the Halite Pipeline Subsidence Assessment (36) the collapse of BW50 and BW44 will not impact on the gas inter-connector and yet mitigation measures are being proposed in regard to BW50 and BW44 in the case of worst case crown hole development. Attempts in the past to prevent continued subsidence have proved unsuccessful.

4.5.28 This clearly indicates that the area is an unsuitable route in regard to gas storage infrastructure.

(35) BGS Report CR/09/037
Rockhead conditions, salt extraction, subsidence and stability of the Preesall Saltfield with comparison to other saltfields; information relevant to gas storage in the halite in the Preesall Saltfield.

4.5.29 Halite attempt to predict the dates of crown hole collapse at BW50 and BW44. (37) The Mott MacDonald Report uses BW48 and BW52 as templates to predict the manner and extent of future collapses at BW50 and BW44.

4.5.30 The manner and timing of catastrophic crown hole collapse cannot be accurately predicted. The collapse of BW 48 was sudden and of short duration. The original cavity cannot be compared to BW50 and BW44.

4.5.31 The collapse of BW52 was only noticed when it was observed that Grange Pool watercourse was flowing in both directions into it. The crown hole has developed in an erratic manner. In the late 1970’s it developed rapidly in a southerly direction. ICI unsuccessfully attempted to shore up the north side depositing large quantities of stone in an attempt to protect Aggleby’s Road. During the 1990’s Agglby’s Road collapsed. This subsidence can certainly not be said to have stabilised at present.

4.5.32 The 1997 report on the stability of two salt extraction craters near Preesall concludes: “The dumping of rip-rap around the perimeter of the Aggleby’s depression seems to be having no clear beneficial effect because it is being displaced by slope failures.” (38)

4.5.33 There are uncertainties on how the lower mine workings may affect the route of the proposed gas inter-connector. The Geological Summary Report states that: “The lower mine extent could not be reliably defined.” (39)

The Pipeline Assessment states: “The mapped lower mine may therefore have been influenced by post-mining dissolution, hence this state and boundary line of the mine should be considered uncertain.” (37)

4.5.34 The Strata Surveys System Risk Report, when reviewing the mine site, refers to brine extraction from the bottom mine workings during the early 1960’s: “In fact controlled brine extraction was continued in the Mine Site brine wells into the early 1960’s although concern was expressed in the 1962 Report W19/23/9 Stage 1 Vol. 2 Part1 Section 2.6. It was considered that solution of the lower salt horizon was occurring and thus extraction volumes were decreased. Thus, the ground below the mine must be considered weak and liable to unpredictable settlement.” (40)

4.5.35 In fact solution may have taken place some distance from the extraction point, the origin of the brine cannot be determined nor where and in which direction the source.

(37) Halite Preevall Underground Gas Sorage Facility, NTS Inter-connector at Preevall – Pipeline Subsidence Assessment Report, Mott MacDonald, March 2011.
(38) Report on the stability of two salt extraction craters near Preevall, Lancashire for I.C.I. Technology by the School of Civil Engineering, The University of Birmingham.
(39) Halite Preevall Underground Gas Storage Facility, Geological Summary Report, Mott MacDonald, March 2010
4.5.36 In their EIA Scoping Report Electricity Connection, Halite make the observation that:

“A potential route on the west bank of the estuary was considered. However as there was no opposition to the route outlined in the 2009 gas storage ES, no change to the route is proposed.”(41)

4.5.37 In fact the unsuitability of the proposed electricity supply route, due to the uncertainty of land stability, has repeatedly been drawn to the attention of Canaxx/ Halite.

4.5.38 The preferred Halite electrical supply route to Stannah Switchyard(42) crosses two main water courses, requires a second river crossing (in addition to the proposed northerly crossing for the brine outfall pipe) and passes through land where ground stability is questionable; the Higher Lickow Farm area and in close proximity to the BW48 subsidence and BW97, where subsidence is imminent.

4.5.39 Halite in their Legacy Brinewell Impact Document Baseline Risk Assessment & Follow Up Actions state:

“In relation to BW97 protective fencing which already exists around this well is recommended to be extended and prioritisation given to further investigation. A well specific risk assessment is recommended to determine appropriateness and safety of investigation techniques.”(43)

4.5.40 BW 97 has been fenced off for a number of years as subsidence was considered imminent. An often attached comment to the current position of Preesall wells, in regard to wells within subsidence risk, was “No work carried out due to being in area of subsidence.”(44) This applied to BW97.

4.5.41 Extension of the exclusion area around BW97 has been recommended in the Mott MacDonald report, this would leave a very restricted area for siting, laying and maintaining the electrical services connector in between BW97 and Highgate Lane.

4.5.42 The stability of the ground in so far as it affects land use is a material consideration, which should be taken into account when deciding a planning application. The proposed development disregards this material planning consideration.

(41) Halite Preesall Underground Gas Storage Facility, Environmental Statement, Volume 1B, Technical Appendices, Appendix 1.1 EIA Scoping Report
(44) ICI Chemicals and Polymers Ltd., Current Position of Preesall Brinewells, 15.11.99.
The route of the electrical connector showing BW 97 on the right.

The route if the electrical connector, Highgate Lane on the left, BW97 on the right.
4.5.43 In the design of modern brine cavities, it was intended that the shape of each individual cavity be designed to be permanently stable. It was intended that pillars of salt be left between the cavities which would be strong enough to support the overburden and that the cavity have a domed roof to create maximum support for the ground above.

Preesall – Typical Cavity Development, 30.12.70(45)

(45) Controlled brine pumping at Preesall – Imperial Chemical Industries Limited, Mond Division.
4.5.44 Cavern development programmes have not always been adhered to, the ICI cavern development, which specified a distance of 30.48m (100Ft) between caverns, was not followed.

4.5.45 Norbert Heitman, Project Manager, Canatxx Presell Gas Storage, confirmed during the Public Inquiry, that the recent sonar survey indicated that the distance between certain existing modern caverns was less than 10m (33ft).

4.5.46 The salt was overworked and many caverns have flat roofs, not the structurally more stable domed roofs as originally intended.

4.5.47 The cavities vary in size and can extend to 110m in diameter and 100m in height. The ICI Typical Cavity Development diagram depicts the diameter of the caverns as 61 m (250ft). This once again raises a question mark over their long term stability.

4.5.48 Not all cavities centre under the well head and irregular shapes occur. Each cavity is unique and has its own history.

4.5.49 BW 62 has a notorious history. I.C.I. twice used explosives to blow off trapped pipes due to roof slides.

4.5.50 During the drilling of BW 130, on the night of 9.1.90, whilst coring just above the salt beds, there was a jolt and the whole drilling rig shook. It was reported that a 5m void had been found.(46).

4.5.51 BW 129 lost its blanket of air during development and has a vertical chimney in it. No investigation of the reasons for this anomaly was undertaken.

4.5.52 The 3 inch pipes have not been lifted at BW 105 as they are trapped due to roof slide.

4.5.53 In 1970 brine from BW 101 bubbled up in the next field 300 metres away. Brine extraction from 101 was ceased.

4.5.54 During the drilling of BW 117 in 1961, on the south side of Aggleby's Road, water was encountered which, came to the surface. Equipment was sent for to remove debris from the bore. The bore was sleeved so that drilling could continue(47). This indicates the presence of wet rockhead in this area.

(46) Statement by Greg Robinson, member of the drilling crew, in regard to the drilling of brine well 130, 16th October 2005.
(47) Letter dated 06.12.05, James Norman Lancaster, member of the drilling crew.
4.5.55 In June 1994, BW 124 gushed intermittently for three hours before being capped. My husband assisted the ICI sub-contractor in capping the well. The reason for the occurrence was not determined at the time.

Brine gusher BW 124, 22.06.94(48).

4.5.56 BW124 had been decommissioned some six months previous to the event and had air released 3 months before, prior to lifting pipes.

4.5.57 After being capped the tap on the brinewell was left open and continued to emit air for a further two weeks.

(48) BW 124, 1-2500 OS Sheet SD3545, map reference 5241, 22.6.94.
4.5.58 At approximately 6 AM on the morning of 18.06.11, the relief milker at Park Cottage Farm became aware that brine was bubbling up from BW45. As the farmer was absent attending his daughter’s wedding in Grange, my husband was contacted.

4.5.59 Darrell attempted to contact Halite personnel and in the interim, I contacted the police to close the road, as it was in a hazardous condition due to brine sludge flowing down Back Lane, Preesall.

4.4.60 BW 45 was sonar surveyed by Canatx/Halite sub-contractors in June 2010, any build up of pressure in the pipe would have been released when the well was accessed for survey.

4.4.61 Mott MacDonald state that compressed air was placed in BW45 in 1911. Why was compressed air placed in BW45 in 1911, as it was not common practice at that time? Also, why did ICI have it on their list for annual monitoring, as it has a salt rock roof?

4.4.62 Brine wells specifically designed with a three pipe system, using compressed air as a blanket, only became standard practice from BW106, May 1960, onwards.

4.4.63 Mott MacDonald in their assessment of the incident make the observation that:

"An assessment of the likely corrosion environment has indicated that the environment in the airlock was likely to have allowed corrosion to occur at a rate of about 0.01 mm/year from the outside only, as the inside was filled with brine. With a casing thickness of about 6mm, this would give an expected life of 600 years." (49)

4.4.64 In fact pipes have been known to fail on the Preesall brinefield previously, for instance in the case of BW106.

4.4.65 On the morning of the 18th June, it was observed that the adjacent well BW78 was emitting brine. This raises the question why was this previously stable well affected?

(49) Assessment of Brinewell Incident Subsurface Aspects, Mott MacDonald. November 2011.
4.5.66 BW 106, where compressed air was used as a blanket material, the outside lining pipe failed in the 1980's, releasing all the air.

4.5.67 Subsequently, I.C.I. fitted a packer ring to the 7 inch inner pipe, positioned at the bottom of the outer pipe at the cavern roof. The 7 inch pipe descended into the cavern, where cavern development was taking place.

4.5.68 The packer ring was locked in place and compressed air put down the 7 inch pipe. The compressed air rose to the top of the cavern and was held in place by the packer ring.

4.5.69 Trapping this air cushion resulted in the release of this air becoming uncontrollable from the wellhead. If the 7 inch pipe was lifted, it would cause a catastrophic release of 200psi of air.

4.5.70 The wellhead of BW 106, carries a danger warning sign.
4.5.71 Some wells are known to be linked by underground pathways. There are at least 18 wells known to be in interconnected groups.\(^{(50)}\)

Map of the brine field depicting some of the linked wells, brine and water mains.

4.5.72 A network of existing pipelines link Eagland Hill, Pilling, The Preesall Brine Field and the Hillhouse Site at Thornton. The Preesall Brine Field also has an extensive internal network of redundant pipelines, all potential conduits for gas migration.

\(^{(50)}\) Brine wells 62, 68 and 65 are connected to each other. 44, 66 and 67 are linked to each other. 51 and 46 are linked. 52, 53, 57, 59, 71, 76 and 80 are all connected to each other. 88, 87 and 93 are linked, also 112 and 126. Some brine wells are also linked into the old mine workings. Strata Surveys Ltd., Risk Assessment, Report No. 7015/56, Stage 3, ICI Hillhouse Brinefield, 30 January 1987.
4.6.1 Potentially Contaminated Land

4.6.2 In 1972, EEC legislation made it no longer acceptable to dispose of waste containing mercury in the Irish Sea. The EEC required the level of concentration of mercury in fish caught, to be reduced from 0.5 mg/kg to 0.3 mg/kg.

4.6.3 On the 29.12.72 a planning application was granted by LCC to I.C.I. for the disposal of residues from the chlorine effluent treatment system of the Hillhouse Site.

BW 107 viewed looking towards Preesall, Highgate Lane can be seen on the other side of the security gates.(51)

(51) Photograph by courtesy of Walter McCann.
4.6.4 In a letter lodged with the planning application, dated 19.05.72, from
the Water Resources Board, it is stated that:

"Seismic survey and pressure tests should be made at regular intervals
and the results communicated to the authority. It is also recommended
that under the terms of the licence periodic analyses should be made
of the brine from the adjacent worked cavities".

4.6.5 Approximately 47,000 tonnes of waste containing 0.5% mercury
sulphide/sulphate was deposited in BW 107 over the period 1972
to 1993.

4.6.6 There is no intention to remove the contents of BW 107 nor is there
any intention to "plug" the borehole. If capped with concrete the
borehole could no longer be monitored\(^{(52)}\).

4.6.7 BW107 has remained in the ownership of NPL Estates and Thornton Business
Facilities Management has continued to maintain it and monitor it's condition.

4.6.8 Wyre Borough Council lists 107 as potentially contaminated land and
as such it is a material planning consideration.

\(^{(52)}\) Letter from Mrs Mason, Environmental Services, Wyre Borough Council, dated 4\(^{th}\) December 2002.
5. **EXTERNAL HAZARDS**

5.1.1 Seveso II Directive

5.1.2 "The Directive contains a specific article on land use planning (Article 12) that specifies that Member States must ensure that the objectives of preventing major accidents and limiting the consequences of such accidents are taken into account in their land use policies and/or other relevant policies. They are required to pursue these objectives especially through controls on the siting of new establishments"(53).

5.1.3 The proposed development area is covered by a network of rural lanes, footpaths and bridleways, which are regularly used for leisure activities.

The Wyre Estuary viewed from Burrows Lane, Stalmine. Burrows Marsh SSSI in the foreground, the Sportsman’s Holiday Home Park, Sportsman’s Lodge and Heads Farm in the centre and Fleetwood in the background(54).

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(54) Photograph by courtesy of Walter McCann.
5.1.4 The Wyre Way in the proposed development area is a well used public path; access to which is uncontrolled and unrestricted.

Without imposing unreasonable restrictions on members of the public, there is no practical way in which any record of assessment could be made of how many members of the public may be in the vicinity of the development at the time of or in the event of a major incident. Nor is there any way that those members of the public could be protected from the effects of such an incident close to this important footpath.(55).

5.1.5 The objectives of the Seveso II Directive are
a) to prevent major accidents and limit the consequences of such accidents and
b) to maintain appropriate distances between establishments and residential areas, areas of public use and areas of particular natural sensitivity or interest (55).

As a publicised linear recreational facility, the Wyre Way clearly constitutes an area of public use. The proposed development would not accord with the objectives of the Seveso II Directive(55).


(55) Report to the Secretary of State for Communities and Local Government, Edward A Simpson JP BA(Hons)
MRTPI, Inspector appointed by the Secretary of State for Communities and Local Government, 30 March 2007.
5.2.1 The Hackinsall Sewage Treatment Works (STW) is surrounded by the proposed development. If the proposed development impacted on the local sewage network, it would cause a serious public health problem. The STW is a significant element of public infrastructure.

5.2.2 United Utilities Water (UUW) have drawn attention to the fact that the proposed development puts at risk both UUW assets and properties/hotels:

"The leakage of gas through fissured ground may have a significant impact on the UUW wastewater asset, particularly UUW's wastewater treatment works (WwTW) in the vicinity of the gas storage caverns, these are:-

Preesall WwTW:
Located to the east bank of the Wyre Estuary it would appear the storage of gas would surround this particular works serving approximate population of 26,000 in Knott End and Preesall.

Fleetwood WwWT:
Located on the west of the Wyre Estuary, this works is less than 2 miles away from the storage caverns and is a very significant works serving the whole of Blackpool and Fleetwood area (a population of up to 426,000 during peak season).(57)

Summary
With the concern that this development brings about risks to millions of pounds of UUW, it is difficult to support the application until it is better understood and significant more information about the ground and design completed.(57)

Fleetwood WwTW approx. value in excess of £130 million, Fylde Tunnel value also in excess of £140 million and Preesall WwTW value of £30 million".(57)
The port of Fleetwood viewed from Knott End Golf Course

5.3.1 The proposed zone for creation of new gas storage salt caverns appears to encroach under Knott End Golf Course. Wellhead1 is sited on land in the ownership of Knott End Golf Club. (58)

5.3.2 Knott End Golf Club acquired this area of land with a view to re-aligning the fairways, when necessary, due to continuing coastal erosion in other areas of the golf links.

5.3.5 The objectives of the Seveso II Directive are
a) to prevent major accidents and limit the consequences of such accidents and
b) to maintain appropriate distances between establishments and residential areas, areas of public use and areas of particular natural sensitivity or interest.

5.3.5 Knott End Golf Course is an area of public use.

6. SAFETY

6.1.1 Approximately 80,000 people live within 3 miles of the proposed COMAH site.

6.1.2 It is a fact that residents within a 3 mile radius of a salt cavern gas storage facility have been evacuated when an accident occurred.

Fleetwood, less than one mile from the Proposed Zone for the creation of New Gas Storage Salt Caverns

6.1.3 It would be impossible to undertake an evacuation of the Fleetwood Peninsular safely and effectively.
6.2.1 The following are some of the recorded salt cavern gas storage incidents:

**CONWAY KANSAS 1966 -2000**
Numerous gas leaks occurred at this storage site.
In 1981 Conway residents were relocated and their homes removed. Gas leaks are still occurring.
(Raffigan 2002, Evans 2009)

**ELK CITY OKLAHOMA 1974**
Gas leaking from a storage facility was the reported cause of 30 tonne boulders being thrown in the air.
(Evans 2008)

**PETAL MISSISSIPPI 25.8.74**
Overfilling of a salt dome storage created a cloud 2km across, 2 explosions broke glass up to 7 miles away. Fire burnt for 5 hours, 24 injured, 3000 evacuated.

**WEST HACKBERRY LOUISIANA 21.9.78**
Accident occurred whilst repairing a leak on the casing, fire ensued, 1 fatality.
(Evans 2008, Evans 2009)

**MONT BELVIEU TEXAS 3.10.1980**
Gas migrated and caused an explosion in a residence, 72 families were evacuated for nearly 5 months.
So many leaks, fires and explosions and other accidents followed that residents pushed to relocate and lined up to sue companies for making their properties worthless.

**MONT BELVIEU TEXAS 24.10.84**
Fire and explosion, the fire ignited a second storage wellhead and caused several million dollars damage to property.

**MONT BELVIEU TEXAS 5.11.85**
Series of fires and explosions, fuelled by 5 salt dome caverns, two people killed and the town's entire population of more than 2,000 residents were evacuated. Following these incidents more than 200 homeowners and several churches accepted buyouts. In December 2000 an explosion destroyed a home, caused the evacuation of 40 homes and the diversion of flights around the area.
There are also reports of explosions at two underground storage wells that then burned for 43 days.

**GOODYEAR ARIZONA 1980's**
Loss of several million cubic feet of propane.
(Pirkle 1986, Evans 2008)
MISSISSIPPI 1980’s
Gas leakage
(Pirkle 1986, Pirkle and Jones, Evans 2008)

VIRIAT FRANCE SEPTEMBER 1986
Rupture on a gas compressor unit that released a gas cloud.

LUKE ARIZONA 1987 & 1988
(Drake 2004)

HALLE EAST GERMANY 29.3.1988
Leak in a salt cavern caused powerful eruptions and due to the acute danger of explosions, an area of 8 square kilometres was evacuated around the 2 kilometre long line of emission spots. Buildings and roads were damaged.

BRAZORIA COUNTY TEXAS 1992
Cavern leaked and had to be abandoned.
(Hopper 2002)

BRENHAM TEXAS 7.4.92
Gas from an underground storage facility exploded, killed 3, injured 22, 26 homes within 1.5 miles of the explosion were destroyed, more than 40 homes damaged.
The explosion registered as a 4+ on the Richter Scale 70 miles away in Houston and the blast was felt up to 160 miles away.

MINEOLA TEXAS 1995
Fire burned for days at a storage cavern.
(Evans 2008)

HUTCHINSON KANSAS 17.1.2001
Gas migrated from the Yaggy underground natural gas storage facility and erupted 8 miles away, causing explosions and geysers, 2 people killed, hundreds of businesses and residences evacuated.

HUTCHINSON KANSAS 7.7.2001
Gas suddenly started venting at high pressure from a deep drilled vent, the flare reached 40 ft in height.

FORT SASKATCHEWAN ALBERTA 26.8.2001
A plume of gas ignited after the failure of a line connecting two wellheads. The fire burned until 3.9.2001.
GRAND BAYOU LOUISIANA 25.12.2003
Natural gas leaked from salt cavern storage, 23 homes evacuated, traffic re-routed, police deployed to prevent looting of abandoned properties.

ODESSA TEXAS 16.3.2004
A faulty gasket caused the release of more than 100 tonnes of natural gas liquids from an underground storage cavern. A Texas environmental official said that it was fortunate that the gas did not meet with a source of ignition.
(Hazardous Cargo Bulletin 2004, Evans 2008)

MOSS BLUFF TEXAS 19.8.2004
Two explosions occurred at a storage facility 40 miles N.E. of Houston, involving 6 billion cubic feet of natural gas. Flames occurred up to 1,000 feet high and could be seen for 30 miles. Officials evacuated all residents within 3 miles of the site.

SULPHER LOUISIANNA 20.10.2004
Following an incident, Yellow Rock, a Mississippi based oil and gas company attempted to warn Sasol about possible problems with their storage cavern. Sasol continued to operate the cavern.
On 22nd January 2008, the jury, in what is believed to be the first ever verdict in the United States against a storage cavern operator, found Sasol North America, Inc negligent in it's operation of a gas storage cavern.
Sasol's cavern 1-A was found to be leaking.
The jury found Sasol's cavern was defective and Sasol's unsafe operation of this cavern posed an unreasonable risk of harm to locals and caused damage to Yellow Rock.
(Evans 2009)

BYERS COLORADO 12.12.2010
Fire burned at a natural gas storage facility for days, in a sparsely populated area, roads closed and evacuation recommended by Sheriff's Office.
(Denver News, CBS Denver, The Denver Post)

EMMINENCE MISSISSIPPI 28.12.2010
Gas leaked for days from a well in a very rural area, families within 1 mile evacuated, roads closed.
The company applied to close and abandon two storage caverns at the site on 22.02.11.
(Hattisberg American, Transco)

MONT BELVIEU TEXAS 08.02.11
Gas explosion, 1 killed, flames could be seen 30 miles west in Houston.
(Huffington Post, KIAH-TV, Houston)
7. IMPACT ON THE LOCAL POPULATION OF THE GAS STORAGE PLANNING APPLICATIONS

7.1.1 Canabxx Energy Ventures Ltd. was first registered with Companies House on 20.12.1991. The company was set up to develop salt cavern gas storage on the Wyre Estuary.

7.1.2 Following the refusal of the third planning application, Canabxx re-branded themselves as the Halite Energy Group Ltd.

7.1.3 The repeated submission of gas storage planning applications has resulted in a high level of stress and anxiety in the local population reflected in an average of 10,000 objections to each of the previous gas storage planning applications.

7.1.4 The Planning Inspector at the 2005/2006 Inquiry, in his Report to the Secretary of State for Communities and Local Government discusses whether the fear expressed by local residents represents a rational response to the proposal:

“Explosions and/or fires resulting from the escape of gas from UGS facilities have occurred in the recent past; two examples being Hutchinson in Kansas, and Moss Bluff in Texas. The ability of domestic gas supplies to cause explosions is generally well know, although fortunately a relatively infrequent occurrence. The Abbeystead disaster of 1984 in which some 16 people had been killed had occurred at a River Wyre outfall north-east of Garstang and is a further reminder to local people of the destructive capability of a gas explosion, albeit that event had not been associated with a proposal for the supply or storage of gas. Against this background, the initial reactions of fear at the potential destruction which could be caused by a “failure” at the proposed UGS facility cannot reasonably be said to be irrational”.(59)

(59) Report to the Secretary of State for Communities and Local Government; Edward A Simpson JP BA(Hons) MRTPI, Inspector appointed by the Secretary of State for Communities and Local Government; 30 March 2007.
8. CONCLUSION

8.1.1 There are so many unknown elements and unanswered questions in regard to the existing brine field development, that the only conclusion can be, that the salt has not been proven capable of storing gas safely.

8.1.2 In October 2007, the Secretary of State, following a lengthy Public Inquiry, agreed with the Planning Inspector’s recommendation and refused the granting of the previous Canatxx Gas Storage Planning Applications.

8.1.3 We believe that The Secretary of State’s reasons for refusal are still valid in the case of the current Halite Gas Storage Planning Application.

PLEASE REFUSE DEVELOPMENT CONSENT APPLICATION NO.EN030001.