

**Report of the Director of Public Health**

Electoral Division affected: All
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**Potential Health Impacts of the Proposed Shale Gas Exploration Sites in Lancashire**

(Appendices 'A' - 'J' refer)

NB. Appendices 'C' - 'G' can be found on the [website](#)

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**Executive Summary**

Lancashire County Council (LCC), the Environment Agency (EA) and the Department for Energy and Climate Change (DECC) are currently in the process of determining the planning applications, environment permits and consent to drill respectively for the two proposed shale gas exploration sites in Lancashire. On 8 May 2014, LCC's Cabinet agreed that the Director of Public Health (DPH) would undertake a Health Impact Assessment (HIA) of these sites at Preston New Road and Roseacre Wood, to be followed in due course by an HIA of the wider industry.

Shale gas exploration, like any other industrial activity, has its risks to the health and wellbeing of the population. Having completed the HIA for each of the two sites the DPH has concluded that the key risks to the health and wellbeing of the residents who live near the two proposed sites in Lancashire include:

- Lack of public trust and confidence, stress and anxiety from uncertainty that could lead to poor mental wellbeing
- Noise related health effects due to continuous drilling, and
- Issues related to capacity for flowback waste water treatment and disposal.

The DPH advises that these risks and other issues highlighted in this report can be mitigated by LCC, EA, DECC, and the Health and Safety Executive (HSE) to protect the health and wellbeing of local residents. In particular:

- There is also a need to be vigilant during the operations, and in emergency preparedness.
- A robust baseline and long term monitoring of environmental and health conditions is required in order to reassure communities and to understand the cumulative and long term effects.
- Local communities should be actively involved and the risks should be communicated in a transparent and reliable manner that is proportionate to the exploratory phase of the industry. This needs a closer working relationship between the industry, national and local agencies as well organisations with

an interest in local shale gas exploration.

- If this industry is to develop further, there is a need for shale gas specific spatial strategy at a local level and an onshore oil and gas industry specific integrated regulatory framework at a national level. Further research on effects of shale gas development on health and wellbeing will help to improve the policy and regulatory framework as the industry moves into production phase.

This is deemed to be a Key Decision and Standing Order 25 has been complied with.

### **Recommendation**

Cabinet is recommended to:

- (i) Endorse the recommendations that the County Council can address and those that are directed to other agencies in this report;
- (ii) Authorise the Director of Public Health (DPH) to take steps to action the recommendations;
- (iii) Note the advice of the DPH to the County Council's Development Management Group (Appendix J refers).

### **Background and Advice**

1. Although onshore oil and gas extraction is a familiar technique in the United Kingdom (UK), unconventional gas extraction through horizontal drilling and hydraulic fracturing is a relatively new industry. The current UK Government's policy is to actively pursue the production of onshore oil and gas. Recent estimates by the British Geological Survey suggests large shale gas deposits to be present in Lancashire.
2. The shale gas industry is at the exploratory phase and is likely to take a number of years before it enters into the production phase. If commercial production occurs in the future, it may bring economic benefits to the region and the country.
3. Various national and local agencies are involved in the planning and regulation of this industry<sup>1</sup>. A summary of the current regulatory road map from Department of Energy and Climate Change (DECC) is shown in Figure 1 shown on Page 3. Appendix 'A' refers to the difference between conventional and shale gas exploration.
4. Like any other industrial activity, shale gas exploration involves potential risks to the environment and health that need to be managed. The policies, regulation and operational standards for shale gas extraction are likely to develop further over the coming months and years in the UK as new scientific and local knowledge emerge.
5. Protecting and improving the environment, health and wellbeing should be of paramount significance for the national Government, local Government, policy

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[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/265988/Onshore\\_UK\\_oil\\_and\\_gas\\_exploration\\_England\\_Dec13\\_contents.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/265988/Onshore_UK_oil_and_gas_exploration_England_Dec13_contents.pdf) accessed on 14/10/2014



(EA), DECC and HSE respectively. Hence, this should be seen as an ongoing process and not a summary of all potential health impacts and the related literature. The findings of this HIA will be kept under review on a regular basis and any new knowledge will be used to advise relevant agencies. Appendix 'J' refers to the DPH's consultation response to the Mineral Planning Authority (LCC).

9. Although undertaking a HIA is not a separate statutory requirement under the onshore oil and gas planning and regulatory regime, considering health issues is generally done as part of an environmental impact assessment (EIA), which can be required through the planning and environmental permitting processes. In addition, there is also an opportunity to consider risks to human health as part of the environment risk assessment that is required by the DECC before issuing petroleum exploration and development licenses (PEDL).
10. HIA is defined as a combination of procedures, methods and tools that systematically judges the potential, and sometimes unintended, effects of a policy, programme or project on both the health of a population and the distribution of those effects within the population. It identifies appropriate actions to manage those effects. The aim is to maximise the positive health impacts and minimise the negative ones as a result of a proposal.
11. Health is defined by the World Health Organisation (WHO) as the state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. UK Government defines public health as helping people to stay healthy, and protecting them from threats to their health<sup>2</sup>.
12. Health is not only influenced by environmental factors but also through social, economic and commercial determinants. Therefore, an HIA is different to the EIA. Generally speaking, planning applicants submit an EIA to demonstrate that they are complying with the legal requirements and that there is no significant impact on environment due to the development. An HIA refers to legal environmental standards but it also aims to support the policy making and planning process to consider the contextual information and the wider impacts of the proposed development on the health and wellbeing of the affected communities.
13. To assess the health impacts effectively, the stages below are usually followed<sup>3</sup>:
  - 13.1.1. **Screening:** Do we undertake an HIA?
  - 13.1.2. **Scoping:** What are the parameters for the HIA study? What are the governance and management arrangements?
  - 13.1.3. **Appraisal:** What are the potential impacts on health? How can we address those impacts?
  - 13.1.4. **Reporting:** Including a Public Health management plan of recommendations to control and manage the health impacts
  - 13.1.5. **Supporting decision-makers:** How do we present the results so that they are both useful and usable by relevant decision-makers?
  - 13.1.6. **Monitoring and evaluation:** This can be process evaluation, effectiveness evaluation or (health) outcome evaluation.

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<sup>2</sup> <https://www.gov.uk/government/topics/public-health>

<sup>3</sup> Scott-Samuel, A., Birley, M., Arden, K., (2001). The Merseyside Guidelines for Health Impact Assessment. Second Edition, May 2001. 20 pages. ISBN 1 874038 56 2. Published by the International Health Impact Assessment Consortium.

14. The methodology for this HIA follows the recognised stages and is based on desktop research combined with community and stakeholder engagement. The screening for the HIA was completed when the Council's Cabinet decided to undertake a HIA of the two proposed sites initially followed by an HIA of the wider industry. It was also agreed that this work would be supported by the Health Advisory Group (HAG), led by the DPH.
15. The HAG was established to support the HIA process and agreed the terms of reference at its first meeting on 19 May 2014 (Appendix 'B' sets out the terms of reference).

### **Scoping of potential health impacts from the proposed exploration sites**

16. Ben Cave Associates Ltd was appointed as the expert HIA Consultant in June 2014, to provide expert HIA support during the HIA process. They supported the scoping and initial appraisal by reviewing the documents submitted by the applicant. The HIA consultants delivered two HIA awareness sessions, which were attended by elected Members and planning officers of LCC and district councils. They also facilitated two community workshops, which were attended by local residents living near the two proposed sites (Preston New Road and Roseacre Wood), interest groups as well as county councillors, district councillors and parish councillors representing the two areas of the proposed sites. [Appendices 'C' - 'G'](#) refer to the reports produced by Ben Cave Associates Ltd.
17. The scope for this HIA includes the human health impacts of the following:
- 17.1.1. Air quality
  - 17.1.2. Greenhouse gases
  - 17.1.3. Hydrogeology and gas
  - 17.1.4. Induced Seismicity
  - 17.1.5. Waste
  - 17.1.6. Transport
  - 17.1.7. Noise
  - 17.1.8. Water
  - 17.1.9. Lighting

### **Appraisal of potential health impacts from the proposed shale gas exploration sites**

18. The appraisal of the potential health impacts of the proposals was based on the scoping and the initial appraisal conducted by Ben Cave Associates Ltd. Ben Cave Associates Ltd completed their work by providing their reports which included an overview and a set of questions for further clarification, to be considered by the DPH before completing the appraisal and making recommendations.
19. The appraisal was completed by the DPH, with support from the HAG, by analysing a range of information available. This included:
- 19.1.1. Reports from Ben Cave Associates Ltd
  - 19.1.2. Clarification response received from Arup
  - 19.1.3. Documents submitted by the applicant to LCC, EA and DECC
  - 19.1.4. Data available on the health profile of the local population
  - 19.1.5. Key national and local policy documents

- 19.1.6. Literature collated by LCC PH department
- 19.1.7. Communications from local residents and elected members.

20. The summary of the preliminary literature search can be found in the overview report produced by Ben Cave Associates ([Appendix 'C' refers](#))

## 21. Limitations of this HIA

- 21.1. While the recent publications on shale gas have been appraised, this did not include a systematic review and a meta-analysis of all the emerging evidence as part of this HIA. This was due to the time constraints in making the recommendations available within the period for the determination of the planning applications and environmental permits.
- 21.2. However, the evidence base available mainly covers experience in the United States of America, Canada and Australia, with relatively little being found that related to the situation in the UK<sup>4 5 67</sup>. Hence, any local quantitative health risk assessment was not possible.

## Findings and Recommendations

The following sections describe:

- The summary baseline health profile
- Site specific findings and recommendations for addressing the health impacts associated with the proposed developments
- Recommendations for future policy development and research based on this HIA.

## 22. Summary baseline health profile

- 22.1. The summary baseline health profile is based on the Fylde district health profile<sup>8</sup>, and the Environment and Health Atlas for England and Wales<sup>9</sup> showing the relative risks for a 25 year period (1985-2009), for a number of health conditions at a ward level. Ward level small area statistics should be interpreted with caution as they are often based on small numbers. The profile presented below provides an estimate of current baselines of health outcomes and will be monitored for any changes in the future.
- 22.2. The proposed temporary Roseacre Wood in Lancashire site is situated within the Newton and Treales ward of the Fylde district, on the east side bordering with the Preston and Wyre districts. In 2013, the Office for National Statistics (ONS) estimated that this ward had a total population of 3,160.

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<sup>4</sup> Potential Public Health Impacts of Natural Gas Development And Production In The Marcellus Shale In Western Maryland accessed online at <http://www.marcellushealth.org/final-report.html>

<sup>5</sup> Please refer to Table 5.2 in Appendix 3 for the list of studies on shale gas extraction and health

<sup>6</sup> Review of potential public health impacts from shale gas extraction by PHE <https://www.gov.uk/government/news/review-of-potential-public-health-impacts-from-shale-gas-extraction>

<sup>7</sup> Researching Fracking in Europe: <https://www.dur.ac.uk/refine/>

<sup>8</sup> Public Health England. (2014). *Local Health*. Available: <http://www.localhealth.org.uk>. Last accessed 30/09/2014

<sup>9</sup> Small Area Health Statistics Unit (SAHSU). (2014). The Environment and Health Atlas for England and Wales. Available: <http://www.envhealthatlas.co.uk/>. Last accessed 01/10/2014

- 22.3. The Newton and Treales ward has the highest life estimated life expectancy at birth (2008-12) for females in the Fylde district of 89 years old. The England national average was 83 years old. For males the ward has a life expectancy at birth (2008-12) of 79, which again is one of the highest estimates in the district and in line with the England national average, across all wards, of 79 years old.
- 22.4. Using the Environment and Health Atlas for England and Wales, the Newton and Treales have above average relative risk for females, for the following conditions: Bladder Cancer; Chronic obstructive pulmonary disease (COPD); Heart Disease; Liver Cancer; Low Birth Weight; Lung Cancer; Mesothelioma Cancer; Still births; and Skin Cancer. And for males, it is estimated to have above average relative risk for the following areas: Chronic obstructive pulmonary disease (COPD); Heart Disease; Liver Cancer; and Lung Cancer.
- 22.5. The proposed temporary Preston New Road in Lancashire site is situated within the Warton and Westby ward of the Fylde district, situated fairly centrally within the district and bordering with the River Ribble to the South and the Blackpool district to the North. In 2013 The Office for National Statistics (ONS) estimated that this ward had a total population of 4,736.
- 22.6. Warton and Westby ward has one of the highest life estimated life expectancy at birth (2008-12) for males in the Fylde district of 80 years old. The England national average was 79 years old. For females the ward has a life expectancy at birth (2008-12) of 82 years old and although this is one of the lower estimates in the district, it is in line with the England national average, across all wards, of 83 years old.
- 22.7. Warton and Westby ward has above average relative risk for females, for the following conditions: Bladder Cancer; Chronic obstructive pulmonary disease (COPD); Heart Disease; Liver Cancer; Lung Cancer; Mesothelioma Cancer; Still births; and Skin Cancer. For males, it is estimated to have above average relative risk for the following areas: Chronic obstructive pulmonary disease (COPD); Heart Disease; Liver Cancer.
- 22.8. Relevant issues for this HIA at Fylde district level are levels of physical activity (but not obesity); mental wellbeing (as indicated by levels of self-harm); and road safety.
- 22.9. A more detailed health profile of the wards in which the two proposed sites are located in is included in Appendix 'H'.

## **23. Site specific findings and recommendations for addressing the health impacts associated with the proposed developments (Appendices '[C](#)' - '[G](#)' and '[H](#)' - '[J](#)' refer)**

It is recognised that there will be an ongoing process to ensure health related issues are considered throughout the development of this industry. Various agencies including DECC, EA, HSE, PHE and LCC will be involved in this process. Hence, the primary aim of this report is to inform the site specific planning, environmental permitting and consenting process by LCC, EA and DECC of the two proposed sites.

Potential health impacts identified in the literature have been considered in this local context and applied to the exploratory phase of the industry. Many of the issues raised by Ben Cave Associates Ltd have been clarified with Arup, EA, HSE and PHE. Hence,



the findings and recommendations in the following sections only relate to the outstanding issues at the time of publication of this report and are proportionate to the exploratory phase of the industry.

Most of the findings and recommendations apply to both Roseacre Wood and Preston New Road sites. However, where relevant, site specific recommendations have been made. Recommendations for future policy and research, based on this HIA are also presented in the subsequent sections. The findings of the HIA will be kept under review on a regular basis and any new knowledge will be used to advise relevant agencies.

## **24. Community understanding of risks associated shale gas exploration** **([Appendix 'F' refers](#))**

- 24.1. The over-riding responses about the two proposed exploration sites voiced by members of the local communities who attended the workshops were those of fear, anxiety and stress, which are affecting their mental wellbeing, with some people experiencing sleep disturbance and depression.
- 24.2. Residents who attended the workshops felt that they did not have a voice, and that their concerns were not being addressed. These responses were associated with a lack of trust and/or confidence in the statutory and regulatory authorities responsible for either the regulation of shale gas exploration and extraction or the protection of residents' health and wellbeing. Again, these issues were affecting residents' mental wellbeing.
- 24.3. Furthermore, the residents in attendance were concerned about the inconsistencies in the information provided by the applicant and other agencies at various points during the planning application process, which led to further anxiety and stress. Residents also raised questions about practices in the shale gas exploration and extraction industry in general, which were a source of worry for them.
- 24.4. In the absence of information from other sources and/or the provision of information that appeared to be inconsistent, many of the residents who attended the workshops had found information on the effects of shale gas extraction and exploration from the published literature and the internet. This information mainly covered experience in the United States of America, Canada and Australia, with relatively little being found that related to the situation in the UK. Residents felt strongly that this information should be considered during the planning process.
- 24.5. Residents felt that, if planning permission was granted for the two proposals, they would be placed at a disadvantage, while receiving no benefits whatsoever. Residents thought the Government would be the main beneficiary, with the possibility of only some benefit accruing to the wider region as a whole.
- 24.6. Anxiety over emergency scenarios featured. Although emergency planning is a requirement for this type of development, this process has not been 'visible' to residents. Anxiety fuelled by uncertainty over this issue could potentially have wider health impacts than the risks themselves.



## **Recommendations to address community understanding of risks associated shale gas exploration**

- R.1. Lancashire County Council (LCC) as the mineral planning authority, along with the Environment Agency (EA), Department of Energy and Climate Change (DECC) and the Applicant should jointly seek to address the issues raised by the local residents through the community engagement workshops conducted as part of this HIA.
- R.2. LCC in partnership with DECC/EA/Public Health England (PHE)/Department of Health (DH), and the Applicant should establish a local public information and assurance programme to communicate and address the local health risks associated with shale gas exploration. Local communities should be actively involved in developing such a programme through existing liaison meetings.
- R.3. LCC, along with EA, DECC, HSE, and the Applicant should publish statements of adherence on the planning and regulatory regime to the local communities at regular intervals.
- R.4. The Applicant should have an effective, swift and consistent process for handling complaints. Local communities should be involved in designing this process.
- R.5. A multiagency protocol should be developed between the national and local agencies to deal with any health related complaints arising from the development.

## **25. Air Quality**

25.1. The air quality impact assessment did not include pollution due to particulate matter, particularly PM<sub>10</sub> and PM<sub>2.5</sub> levels. The Applicant has explained that this is due to the following reasons:

- 25.1.1. PM<sub>10</sub> from flare emissions is screened out as not significant because the temperature at the flare is very high that the emissions will not include significant levels of PM<sub>10</sub>
- 25.1.2. PM<sub>10</sub> emissions from the generators have been screened out because the emissions at ground level will only affect an area that is few 100 metres away
- 25.1.3. PM<sub>10</sub> from drilling and vehicles on site have been screened out as insignificant.
- 25.1.4. Therefore, cumulative levels of PM<sub>10</sub> have been screened out.

25.2. Hence, it is not possible to estimate the health impacts due to cumulative emissions of particulate matter from various sources associated with this development but any impacts are likely to be small because of the likelihood

of low levels of emissions. However, it is noted that the applicant has proposed to install ambient air quality monitors on site.

25.3. Discussion with EA confirms that emissions from the drilling, generators and vehicles are not covered by the EA permit. However, Fylde Borough Council is the responsible authority for air quality management in the area. The proposed sites are not part of an existing Air Quality Management Area (AQMA).

25.4. Comparison of UK Air Quality Standards and WHO Guide values used to inform the recommendations in this report is given in the Table 1 below.

**Table 1: Comparison of UK Air Quality Standards and WHO Guide Values**

Pollutant	UK Air Quality Standards	WHO Guide Values
Particles (PM <sub>10</sub> )	50 µg/m <sup>3</sup> 24 hour mean (Not to be exceeded more than 35 times a year)	50 µg/m <sup>3</sup> 24 hour mean
	40 µg/m <sup>3</sup> annual mean	20 µg/m <sup>3</sup> annual mean
Particles (PM <sub>2.5</sub> )	25 µg/m <sup>3</sup> annual mean	10 µg/m <sup>3</sup> annual mean
Nitrogen dioxide	200 µg/m <sup>3</sup> 1 hour mean	200 µg/m <sup>3</sup> 1 hour mean
	40 µg/m <sup>3</sup> annual mean	40 µg/m <sup>3</sup> annual mean
Ozone	100 µg/m <sup>3</sup> 8 hour mean	100 µg/m <sup>3</sup> 8 hour mean
Sulphur dioxide	125 µg/m <sup>3</sup> 24 hour mean	20 µg/m <sup>3</sup> 24 hour mean

### Recommendations to address air quality

- R.6. LCC should ensure through the planning process that during the project, the cumulative levels of air pollution do not exceed the national air quality objective thresholds during the peak activity period. Specifically, the cumulative PM<sub>10</sub>, 24 hour mean levels from the flare, generators, drilling and vehicles should not exceed 50 µg/m<sup>3</sup> 24 hour mean (not to be exceeded more than 35 times a year).
- R.7. An agreement should be reached with the Applicant to monitor ambient air quality on site measuring all the common air pollutants representative of the activity at the site, including PM<sub>10</sub> and combustion gases. The results should be reported to LCC and Fylde Borough Council on a regular basis.
- R.8. The Applicant should demonstrate to LCC that best available techniques are being used to keep air pollution due to the development as low as reasonably possible

## 26. Greenhouse Gases

26.1. As greenhouse gas emissions have the capacity to contribute to global warming, and therefore climate change, it is pertinent to consider the part the project may play in either contributing to or detracting from global warming.

- 26.2. Carbon dioxide is a greenhouse gas, which is a natural and vital part of the atmosphere. It helps to prevent the earth from cooling down overnight from heat loss to the atmosphere, acting as a protective blanket. Too much, however, prevents the appropriate release of heat from an otherwise balanced system. As the global temperature increases, the earth's climate becomes more unstable, leading to extreme weather events, with attendant problems, such as the flooding experienced in the UK during winter of 2013/14.
- 26.3. Other gases in the atmosphere have a global warming potential too. For example, methane has a global warming potential 24 times greater than that of CO<sub>2</sub>.
- 26.4. A recent study by DECC Chief Scientist who examined the carbon footprint and climate change implications for UK shale gas found that the carbon footprint for shale gas is significantly less than that for coal when used for electricity generation (423 – 535 gCO<sub>2</sub>e/kWh(e) versus 837 – 1130 gCO<sub>2</sub>e/kWh(e)). The study also found that, if well regulated, local greenhouse gas emissions from shale gas operations should represent only a small part of the carbon footprint. Most carbon emissions will come from its final use as a fuel.
- 26.5. The duration of the initial flow testing is be between 60 and 90 days. It is apparent that depending on the sequential viability of the exploration stage, the wells will be drilled, fractured and flared sequentially with some overlap. It is therefore expected that there will be drilling, hydraulic fracturing, and flaring of the four wells in each site and this could last for at least 240 to 360 days during this project. Although this is temporary, it is not considered short term for the purposes of this HIA.
- 26.6. Discussion with EA indicates that there is no current threshold or permissible levels for regulating fugitive emissions. However, it is understood that the level of fugitive emissions will be measured.
- 26.7. Limited evidence is available on the long term fugitive emissions from the wellhead and migration of gas in the UK context. Well integrity has also been identified as a priority by the review of hydraulic fracturing conducted by the Royal Society and the Royal Academy of Engineering in their review and in the literature<sup>1011</sup>.

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<sup>10</sup> Accessed online at <https://royalsociety.org/policy/projects/shale-gas-extraction/report/>

<sup>11</sup> Richard J Davies et al; Oil and gas wells and their integrity: Implications for shale and unconventional resource exploitation; Marine and Petroleum Geology; Volume 56, September 2014, Pages 239–254

- 26.8. There is a specific set of occurrences that the well operator must report to HSE under RIDDOR (Reporting of Injuries, Diseases and Dangerous Occurrences Regulations) process.
- 26.9. It is understood that an application for the variation of the environmental permit will be required by the Applicant to continue with the extended flow testing phase. However, the land use planning permission will be determined for both initial flow testing and extended flow testing.

#### **Recommendations to minimise greenhouse gas emissions**

- R.9. EA should consider requiring the Applicant to measure the levels of fugitive emissions and establishing conditions on the maximum permissible levels for fugitive emissions.
- R.10. EA should consider requiring substantial permit variation when the Applicant applies for extended flow testing period.

### **27. Emergency preparedness**

- 27.1. During the extended flow testing, which could happen for 18 – 24 months, gas will not be flared. Instead, it will be treated and piped in to the gas grid. To allow connection to the gas grid a buried pipeline will be laid (1.2m depth and 6 inches in diameter). It will run 55m eastwards to the Roseacre Wood site to connect to the gas line running north to south direction. At the connection point, National Grid would require separate fenced off areas of approximately 8m x 9m. It is understood that LCC is awaiting a response from the National Grid.
- 27.2. Modelling to identify the zone of risk in the event of pipeline failure or the risk assessment of pipeline safety during the extended flow testing phase is not apparent in the Environmental Statements or in the Environmental Risk Assessment submitted to the DECC.
- 27.3. Without the details of this planning application, it is not possible to assess the health impacts relating to emergency preparedness at this stage.

## Recommendations for emergency preparedness

- R.11. LCC should seek further guidance from HSE to establish whether the site and the associated developments at the connection point to the gas grid during the extended flow testing period is within any zone of a consultation distance from the pipeline.
- R.12. DECC should consider pipeline safety risk assessment during the extended flow testing period to be included in ERA before giving consent to drill.
- R.13. HSE should confirm that the requirements for land use including the associated developments at the connection point to the gas grid during the extended flow testing period, can be met with the two proposed sites.

## 28. Noise

- 28.1. Health effects that may result from community noise are well documented and include interference with communication; annoyance responses; effects on sleep, and on the cardiovascular and psychophysiological systems; effects on performance, productivity, and social behaviour; and noise-induced hearing impairment<sup>12</sup>
- 28.2. The National Planning and Policy Framework (NPPF) describes observed effect levels for noise as below:
- Significant observed adverse effect level above which significant adverse effects on health and quality of life occur
  - Lowest observed adverse effect level: this is the level of noise exposure above which adverse effects on health and quality of life can be detected
  - No observed effect level: this is the level of noise exposure below which no effect at all on health or quality of life can be detected.
- 28.3. The NPPF guidance also suggests that mineral planning authorities should aim to establish a noise limit, through a planning condition, at the noise-sensitive property that does not exceed the background noise level (LA90,1h) by more than 10dB(A) during normal working hours (07:00 - 19:00)<sup>13</sup>. Where it will be difficult not to exceed the background level by more than 10dB(A) without imposing unreasonable burdens on the mineral operator, the limit set should be as near that level as practicable. In any event, the total noise from the operations should not exceed 55dB(A) LAeq, 1h (free field). For operations during the evening (1900-2200) the noise limits should not exceed the background noise level (LA90,1h) by more than 10dB(A) and should not exceed 55dB(A) LAeq, 1h (free field ). For any operations during the period 22:00 – 07:00 noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event, the noise limit should not exceed 42dB(A) LAeq,1h (free field) at a noise sensitive property.

<sup>12</sup> <http://www.who.int/docstore/peh/noise/introduction.htm>

<sup>13</sup> <http://planningguidance.planningportal.gov.uk/blog/guidance/minerals/assessing-environmental-impacts-from-minerals-extraction/noise-emissions/>

28.4. The WHO guideline values used for the purposes of determining health impacts due to noise is given in Table 2 below. In particular, the WHO general health based threshold of 50/55 dB LAeq, 16hr and the WHO night noise threshold of 40 dB L night, outside.

**Table 2: WHO guideline values on critical health effects due to noise**

Specific environment	Critical health effect(s)	Leq [dBA]	Time base [hours]	Lmax, fast [dBA]
<b>Outdoor living area</b>	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
<b>Dwelling, indoors</b>	Speech comprehension and moderate annoyance, daytime and evening	35	16	45
<b>Inside bedrooms</b>	Sleep disturbance, night-time	30	8	45
<b>Outside bedrooms</b>	Sleep disturbance, window open (outdoor values)	45	8	60
<b>School class rooms and pre-schools, indoors</b>	Speech intelligibility, disturbance of information extraction, message communication	35	during class	-
<b>Pre-school bedrooms, indoors</b>	Sleep disturbance	30	sleeping-time	45
<b>School, playground outdoor</b>	Annoyance (external source)	55	during play	-
<b>Hospital, ward rooms, indoors</b>	Sleep disturbance, night-time	30	8	40
	Sleep disturbance, daytime and evenings	30	16	-
<b>Hospitals, treatment rooms, indoors</b>	Interference with rest and recovery	#1		
<b>Industrial, commercial shopping and traffic areas, indoors and outdoors</b>	Hearing impairment	70	24	110
<b>Ceremonies, festivals and entertainment events</b>	Hearing impairment (patrons:<5 times/year)	100	4	110
<b>Public addresses, indoors and outdoors</b>	Hearing impairment	85	1	110
<b>Music through headphones/earphones</b>	Hearing impairment (free-field value)	85 #4	1	110
<b>Impulse sounds from toys, fireworks and firearms</b>	Hearing impairment (adults)	-	-	140 #2
	Hearing impairment (children)	-	-	120 #2
<b>Outdoors in parkland and conservation areas</b>	Disruption of tranquillity	#3		

#1: as low as possible; #2: peak sound pressure (not Lmax, fast), measured 100 mm from the ear; #3: existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low; #4: under headphones, adapted to free-field values

28.5. While hydraulic fracturing will only happen during the day, drilling is planned to happen continuously, 24 hours a day, including night time. Given that the wells will be drilled sequentially, it is expected that the noise levels will be continuous for at

least 14 months. The Applicant's predicted noise level at sensitive receptors is given in the Table 3 below.

**Table 3: Night time noise levels due to drilling at various receptors compared against significant levels**

Receptor	Baseline noise level (night time)	Predicted noise levels (dBLAeq)	Criteria used in the environmental statements (dBLAeq)	Significant effect levels in NPPF LAeq,1h/WHO dB Lnight, outside thresholds during night time
Plumpton Hall farm (PNR)	42	39	45	42/40
Staining wood cottages (PNR)	46	47	50	42/40
Old Orchard Farm (RW)	33	45	45	42/40
Roseacre Farm (RW)	36	41	45	42/40

28.6. It is evident from the table above that baseline noise levels near Roseacre Wood site is within the WHO thresholds but not near the Preston New Road site. In particular, the night time noise level at Old Orchard farm is likely to be 12 dB more than its baseline. Left unmitigated, this is likely to cause significant health effects, particularly related to sleep deprivation.

28.7. It is noted that the background levels near Preston New Road site is already at or above the recommended levels. Although the additional noise due to the development is not considered significant, levels of night time noise in the vicinity of Preston New Road cannot be ignored.

28.8. It is very likely that the increase in the night time indoor noise levels, particularly from the Roseacre Wood site, will be noticeable and intrusive. There is a significant risk of health effects, particularly sleep disturbance and the related effects, during the project.

#### **Recommendations to address health impacts of noise**

R.14. LCC should consider further noise assessment and require that mitigation measures are in place to keep the night time outdoor noise to below 40dBLnight, outside.



## 29. Induced Seismicity

- 29.1. There is a residual concern amongst resident attending the community engagement workshops that in spite of seismicity monitoring array, there is a rare chance of surface tremor being felt and damage occurring to the local properties.
- 29.2. Although extremely unlikely, it is not clear how the risk of minor surface tremors

### Recommendations to address issues related to induced seismicity

- R.15. The Applicant should demonstrate to LCC that liability/compensation arrangements are put in place to cover the structural damages to properties due to any unlikely event of induced seismicity.
- R.16. The Applicant and DECC should confirm how the risk of minor tremors that might be perceived will be communicated with the local communities. This should be established before DECC provides the consent to drill.

that might be perceived will be communicated with the local communities.

## 30. Waste

- 30.1. The Environment Statements (ES) submitted by the Applicant describe that the waste generated by the personnel on site, in the form of general waste from canteen and office areas will not result in a significant effect. This also applies to inert and non-hazardous waste. Similarly, the quantity of waste generated by the Project (construction, drilling, hydraulic fracturing, initial and extended flow testing and decommissioning) is reported not to result in a significant effect. The chapter states that this is because there is sufficient capacity to treat the waste generated by the Project. However, the applicant concludes that, although there is sufficient capacity to treat flowback fluid it is still anticipated to result in a significant effect because at peak times it will utilise a major proportion of the available treatment capacity within 100 miles of the Site (based on radiation levels and physical treatment capacity).
- 30.2. Therefore, it can be expected that additional, onsite, temporary capacity to store flowback fluid might be needed.
- 30.3. Measures proposed by the environmental statements (ES to mitigate this effect are being developed and these include:
  - 30.3.1. Use of additional treatment capacity at facilities within northern England.
  - 30.3.2. Investment in on site treatment to recycle flowback fluid for use in hydraulic fracturing and to reduce the quantity of waste generated.
  - 30.3.3. Regulating the quantity of flowback fluid generated at the Site to not exceed the available waste treatment capacity.
- 30.4. The application provides the general pre-construction description of how waste will be managed, and disposed. It does not make any reference to

minimisation of consumption, re-use, circular economy, and re-deployment of equipment.

- 30.5. It is clear that waste from this activity will place additional demand on the landfill regime. The Applicant indicates that the percentage space to be occupied is around 1% for landfill.
- 30.6. The Environmental Impact Assessment scoping document also refers to production of liquid hydrocarbons. This is an area of uncertainty for the project as the presence of oils can only be determined once the process is underway. Management of waste potentially containing hydrocarbons remains an issue.
- 30.7. The limited capacity of identified treatment facilities to manage the flowback fluid from both sites is identified in the resources and waste chapter of the ES as a very substantial significant impact. When the output is assessed with the potential for being cumulative with Roseacre Wood, the quantity produced would be 68% of available capacity. The applicant states that care would be taken during operation not to lead to a capacity issue.
- 30.8. The ES notes that mitigation may include additional tank capacity onsite to store flowback fluids temporarily. The aim appears to create buffer capacity issues at treatment plants. In the ES there is no indication of a limit on such additional storage. The maximum onsite capacity should be determined in advance to ensure the site's surface spill containment capacity is appropriate in the event of worst case containment failure. Discussion with EA suggests that the site has the sufficient containment capacity. Although containment failure is referred to in the Environment Risk Assessment submitted to the DECC, it is not clear whether the maximum additional capacity of the onsite tanks for storing flowback fluids temporarily has been taken into account for calculating the risk of surface water contamination.

#### **Recommendations to address issues related to waste**

- R.17. EA should establish whether remaining fracking fluid left in the wells will be considered as waste and how they will be monitored in the long term following the surrender of the permit.
- R.18. EA and LCC should satisfy themselves that there are adequate waste treatment facilities available for safe storage, transport and disposal of the waste generated before the permit is granted.
- R.19. EA should establish the maximum additional storage for flowback fluid and ensure that the site's spill containment capacity takes into account additional capacity.

### **31. Lighting**

- 31.1. The ES conclude that due to the combination of relatively few sources of night time lighting at the sites, use of lighting during the project is predicted to have a significant effect for all project activities without mitigation except for installation of the surface and buried arrays, construction, decommissioning and restoration. By implementing mitigation measures it is reported that the potential effects of lighting being directed towards windows of properties and the intensity of lighting used are not significant. The ES states that these measures also help to reduce the magnitude of the sky glow and building luminance effects although there is a temporary residual significant effect which remains following mitigation.
- 31.2. Although the use of the flare stacks will be keeping the flames within the stack, it is possible that there is still a glow from this. Flare light is mentioned in the project's permit application. The permitting application assesses the potential for light impacts from the enclosed flares as a low risk and does not carry the issue forward to the risk assessment management plan. The issue is not explicitly discussed in the ES lighting chapter, but would contribute to sky glow.
- 31.3. The ES acknowledges that the project is to be centred in a dark sky area, and as such any light which is to be introduced will be an increase on existing levels. The applicant intends to adhere to good practice, ensuring that lights are focused downwards. It is noted that this would not be possible for sky glow from the flare stacks.
- 31.4. When the drill rig has been put into place the lighting which is on the rig will be at height, and visible from quite a distance, above any hedgerows which may have grown upwards. The Applicant acknowledges that this will be a major significant impact pre-mitigation and expects to offset this by good practice, and by responding to complaints rapidly.
- 31.5. When exposed to overnight light, people can have disturbed sleep patterns. Although uncertainty remains, there is plausible epidemiological evidence that circadian rhythm disruption has a variety of adverse physiological effects<sup>1415</sup>.
- 31.6. The sensitive receptors identified will have light from several sources: the security lighting at about 10 feet in height; transient, intermittent intensive lighting from construction, and the longer term rig lighting, which will be at height and is likely to impact a greater number of receptors.

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<sup>14</sup> The health impacts of environmental nuisances and their contribution to health inequities.  
<http://www.cieh.org/assets/0/72/948/129834/2b7f0c99-0531-4c0a-81ef-a37c5fe98f32.pdf>

<sup>15</sup> Missing the Dark: Health Effects of Light Pollution; <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2627884/>

## **Recommendations to address issues related to light**

R.20. LCC should ask the Applicant to consider offering to fit blackout blinds in the bedrooms facing the site of the homes where impacts are expected.

## **32. Transport**

- 32.1. The health profile for the Fylde district shows that road injuries and deaths in Fylde are significantly worse than the England average. Any change caused by the project that could affect road safety is therefore an important issue for the HIA.
- 32.2. The specific focus for this HIA is on the potential increase in accidents, use of the routes for cycling and walking; and the safe transport of waste and flowback water.
- 32.3. Specific issues for Roseacre Wood site include:
  - 32.3.1. The roads in the vicinity of the site are narrow and that it will be necessary to construct passing places.
  - 32.3.2. The impact on the village of Wharles depends on the viability of the Defence High Frequency Communications Service (DHFCS) Inskip route. It is understood that a risk assessment has been conducted by MoD but the results are not available while conducting the HIA.
  - 32.3.3. The site visit by Ben Cave Associates Ltd shows that HGVs with large loads e.g. 40ft trailers for office space and work space would have difficulty safely negotiating the routes in proximity to the project site.
  - 32.3.4. Report by Ben Case Associates Ltd also suggests that although distant from the site surface infrastructure, the potential traffic impact at Clifton should not be overlooked. It notes that Clifton village is residential with a playground accessed across the main road with no formal crossing point. The road capacity does not appear to be any greater in Clifton than elsewhere on the route (once off the A583). Clifton could be viewed as an already saturated location rather than one that is justifiable due to existing levels of traffic movements. The ES notes that accident rates for this stretch are higher than the route section closer to the site. Pedestrian impacts (particularly children accessing the playground) are likely to be a concern, particularly given that the project's operations include transport movements outside of normal work hours, including Saturday mornings.
  - 32.3.5. It is understood that the road through Clifton is a 20 mph zone and also the route for the nuclear reprocessing plant in the area.
- 32.4. Although it is accepted that there are two different routes through Lancashire to the main highways (from Roseacre Wood and Preston New Road respectively) for transportation of waste, the impact then becomes aggregated on the motorways. Although an assessment of this is not required within the planning regime, the health impacts over time and at geographical locations

which are not local to the proposed activity need to be considered by relevant agencies depending on the final transport routes for waste disposal.

- 32.5. Although the proposed sites and associated developments do not affect any public rights of way, perception of risks by the community about the safety of the routes could have an impact on how the routes will be used for walking and cycling.

#### **Recommendations to address issues related to transport**

- R.21. The Applicant should demonstrate to LCC how the specific risks due to using the MoD site for transport will be addressed.
- R.22. LCC should establish that appropriate traffic management options to address the public concerns, particularly in Roseacre Wood, are available.
- R.23. LCC should satisfy itself that appropriate actions can be taken to maintain road safety, particularly on the access routes to Roseacre Wood site and continue to monitor road safety related incidents on the access to both the sites.

### **33. Occupational health risks**

- 33.1. There is limited evidence on occupational health risks due to cumulative exposure to silica dust, noise and air pollution during shale gas exploration in the UK context.
- 33.2. Health and Safety Executive (HSE) approach is based on goal setting to keep the exposure to occupational hazards as low as reasonably practicable. HSE will not seek regular report from the employer but will respond to concerns raised. Discussion with HSE suggests that there was an issue related to exposure to silica at the Preese Hall site which was addressed by requiring silica to be handled in enclosed containers.
- 33.3. It is understood that there are no specific occupational health standards for onshore oil and gas extraction. The Applicant has proposed a framework for health and safety at work as part of their governance system that will comply with HSE requirements.

### **Recommendations to address occupational health risks**

- R.24. Given this is a relatively new industry with a complex set of regulations, HSE should consider requiring the operator to undertake a comprehensive health surveillance of workers comprising of exposure to noise, air pollution, fugitive emissions, dust, silica, and handling waste.
- R.25. The Applicant should share the data collected on occupational health surveillance of workers involved in shale gas exploration activities with LCC.
- R.26. HSE should consider sharing the information on RIDDOR incidents related to the shale gas exploration sites with the Director of Public Health.

### **34. Baseline and long term monitoring of environmental and health conditions**

- 34.1. It is apparent that a variety of environmental baseline data will be collected by the Applicant and required by various agencies before any activity starts on the sites. There is no similar requirement for measuring health impacts on the communities living in the vicinity of the sites. It is not known how data from various sources measuring operating standards, environmental and health conditions will be collated, analysed and shared with the public.
- 34.2. Robust baseline and ongoing monitoring could be used to reassure local communities and identify any association between the industrial activity and health effects in the longer term.
- 34.3. Long term well integrity is based on a variety of factors including the local geology. There is paucity of data on the long term environmental and health effects of fractured onshore wells in the UK. Long term monitoring of well integrity, environmental and health conditions is not a requirement by EA when the operator surrenders the permit. However, the EA must be satisfied that environmental conditions are acceptable and will remain so before it accepts the surrender of a permit.
- 34.4. Establishing a comprehensive baseline and long term monitoring of environmental and health conditions would also inform future development of the industry and the regulatory framework.

### **Recommendations to establish baseline and monitoring of environmental conditions**

- R.27. LCC should seek agreement with the Applicant to establish a baseline and ongoing monitoring of environmental and health conditions prior to beginning any activity on the sites. This is mainly to reassure local communities about the safety of shale gas exploration activities.
- R.28. The Applicant should consider establishing a baseline and monitoring as a community benefit and commit resources to enable this happen.
- R.29. HSE should consider publishing the findings from well integrity inspections on a regular basis.
- R.30. EA should ensure long term plans should be in place for monitoring any contamination.
- R.31. DECC should confirm that operators have an open-ended liability to remedy any well leakage problems after permit surrender and site restoration. In the event an operator can no longer be identified, DECC should clarify who is liable for remediation.
- R.32. LCC, EA, HSE and DECC should inform the Director of Public Health if there is a breach to the planning permission, environmental permit, consent to drill or any other regulatory control that relates to health and wellbeing of local residents.

### **35. Areas for future policy development**

While this report is focussed on the proposed sites, a number of themes for future policy and research development have been identified during the HIA. These are described below:

#### **Local**

- 35.1. The Lancashire Joint Advisory Committee for Strategic Planning oversees the production of the Minerals and Waste Local plan and is currently consulting on the Onshore Oil and Gas Supplementary Planning Document. There is no specific spatial strategy for future development of shale gas in Lancashire.
- 35.2. The two tier nature of LCC's administrative area means that district councils are responsible for certain issues like air, quality and nuisance due to noise while mineral extraction and waste planning is the responsibility of LCC. Like most industrial processes, it was evident from the HIA that no one organisation is responsible for the regulation of the cumulative impacts of shale gas exploration in the area. For example, flare emissions are regulated by the EA while Fylde Borough Council is responsible for air quality management. However, in determining the planning applications, LCC must take account of cumulative impacts.
- 35.3. The new responsibilities of LCC in protecting and improving health of local residents require much more closer working between EA, HSE, LCC, PHE, Fylde Borough Council and DECC in implementing the planning and regulatory regime.



### **Recommendations for local policy and practice**

- R.33. The Lancashire Joint Advisory Committee for Strategic Planning should consider developing a shale gas spatial strategy to inform the future development of the industry in Lancashire.
- R.34. LCC should consider developing an integrated shale gas planning process through more closer working between EA, HSE, LCC planning and public health functions, PHE, Fylde Borough Council and DECC.
- R.35. LCC should consider a site specific HIA to be conducted for future applications related to shale gas development. Where applicable, LCC should embed a full site specific HIA as part of the scoping for the EIAs.
- R.36. LCC should evaluate the implementation of the recommendations in the HIA report.

### **National**

- 35.4. The policies relating to the health impacts of shale gas industry crosses various Government departments and national agencies i.e. DECC, Department for Environmental Food and Rural Affairs (DEFRA), EA, HSE, Department for Communities and Local Government (DCLG), British Geological Survey (BGS), Department of Health (DH) and Public Health England (PHE). While there is a lot of focus on environmental issues, considering unplanned scenarios and wider health and wellbeing impacts of shale gas industry on the local communities could be improved. This is particularly important when the industry enters into the production phase.
- 35.5. It is not clear how the scoping opinion of environmental risk assessment was determined and whether the risks associated with extended flow testing have been considered by the DECC.
- 35.6. If the industry increases in scale, an industry specific integrated regulatory framework for onshore oil and gas industry is likely to bring some focus on issues like hydraulic fracturing, fugitive emissions and climate change, and long term well integrity.

### **Recommendations for national policy and guidance development**

- R.37. DECC should consider bringing the relevant regulations into a single onshore oil and gas specific regulatory framework to enable a safer and sustainable development of the industry. However, local planning control should be maintained. This is likely to support the developers in navigating the regulatory regime more easily and also protect the health and wellbeing of local residents.
- R.38. DECC and EA should consider embedding public health impact assessment in their future policies and guidance related to shale gas.
- R.39. DECC and EA should consider producing policy, guidance and standards for fugitive emissions of greenhouse gases from shale gas exploration as soon as possible.
- R.40. EA should consider monitoring cumulative impact of all sources of emissions on ambient air quality and not just the flare emissions.
- R.41. EA, DECC, DH and PHE should consider establishing a national framework to monitor the health and environmental impacts of onshore unconventional oil and gas extraction.
- R.42. UKOOG should work together with Local Government Association (LGA) and other national agencies in developing a risk communication framework to be used with the local communities.
- R.43. The LGA should consider establishing a network of local authorities involved in onshore oil and gas exploration to share examples of good practice and protect the health and wellbeing of local communities.
- R.44. The LGA, Association of Directors of Public Health (ADPH) and PHE should support the local authorities in developing a comprehensive HIA framework and promote its use in areas where shale gas exploration is being planned.

### **36. Areas for future research**

- 36.1. Lancashire is at the forefront of shale gas exploration in the UK. While the research on the environmental and geological aspects of shale gas exploration are under way, there is very little, if any, research on human health impacts in a UK context.
- 36.2. Recent reports on public health impacts of shale gas highlight the need for further development of HIA methodologies specifically for unconventional gas extraction in the UK.

## **Recommendations for research**

R.45. LCC, in partnership with PHE, EA and the Department of Health, should lead the development of a research programme on shale gas and human health impacts. There should be a particular focus on long term effects and a community understanding of risk is needed in the UK context. This will inform the development of policies, regulation, industrial practice and risk communication with the public.

## **37. Conclusions**

- 37.1. The findings from the HIA suggests that whilst there might be benefits of shale gas exploration to the economy, there are also risks. The HIA recognises that although the exploration of shale gas is temporary, it is not short term.
- 37.2. The risks to health and wellbeing of the population from the two proposed sites in Lancashire include lack of public trust and confidence, stress and anxiety from uncertainty which could lead to poor mental wellbeing, noise related health effects, and issues related to capacity for flowback waste water treatment and disposal. These risks can be addressed by implementing the recommendations in this report.
- 37.3. The risks are particularly prominent for residents living near the Roseacre Wood site compared to the Preston New Road site due to the lower levels of background noise, access through narrow roads, and proximity to major gas pipeline of the national grid. These need to be prevented, mitigated and monitored through the permitting and planning process.
- 37.4. There is a need to be vigilant during the operations to minimise the impact of shale gas exploration on air quality, greenhouse gases, light pollution, transport, occupational health, and in emergency preparedness.
- 37.5. A robust baseline and monitoring of environmental and health conditions is required in order to reassure local communities and understand the cumulative and long term effects. The applicant and the industry should play their part in supporting this.
- 37.6. Local communities should be actively be involved and the risks should be communicated in a transparent and reliable manner that is proportionate to the exploratory phase of the industry. This needs a closer working relationship between the industry, national and local agencies as well organisations with an interest in local shale gas exploration.

- 37.7. LCC, EA and DECC should satisfy themselves that the recommendations in this report are addressed prior to granting permits, planning permission or consent to drill.
- 37.8. Ensuring adequate resources are available with the regulatory and public health agencies will be a key factor in improving public confidence and address risks.
- 37.9. If this industry is to develop further, there is a need for local shale gas specific spatial plan and a national industry specific integrated regulatory framework.
- 37.10. Further research and development of methods for assessing the cumulative health impacts of shale gas is also needed.
- 37.11. LCC should be engaged on an ongoing basis in protecting and improving the health of its residents and share the lessons learnt from this HIA with other authorities.

**Acknowledgements:**

The author of this report is grateful to all those who have given their valuable time throughout the process of undertaking this Health Impact Assessment (HIA). This includes:

- Local residents
- County Councillors, District Councillors and Parish Councillors
- Health Advisory Group
- Fylde Borough Council
- Environment Agency
- Health and Safety Executive
- Public Health England
- ARUP
- Colleagues in Lancashire County Council

**Consultations**

N/A

**Implications:**

This item makes recommendations to various agencies in improving the policy, planning and regulatory framework.

**Risk management**

N/A

## **Finance**

Any impact on the Council regarding Shale Gas Extraction will be addressed within the appropriate planning process.

### **List of Background Papers**

Paper	Date	Contact/Directorate/Tel
Report to Cabinet – 'Proposal to undertake a Health Impact Assessment of Shale Gas Extraction in Lancashire'	8 May 2014	Dave Gorman, Office of the Chief Executive, (01772) 534261

Reason for inclusion in Part II, if appropriate

N/A