Appendix 3

Air Quality

Proposal

The applicant has assessed air quality impacts in Chapter 6 and Appendix E of the Environment Statement. Further information has also been submitted by the applicant. The ES and further information predicts the likely changes in pollutant concentrations as a consequence of the project. These are then compared to air quality objectives and limit values for these pollutants to determine whether the predicted changes are significant.

The area in which the site is situated is rural and not densely populated. There are no existing significant sources of emissions to the atmosphere. Likewise, there are no areas within the immediate vicinity of the site where there is an existing problem with air quality or pollution.

The project has five main activities that will result in emissions to air. These are:

- Emissions from construction activities;
- Emissions from the vehicles associated with the use of the site;
- Emissions from the flaring of gas during flow testing;
- Emissions from equipment associated with the operation of the Site (e.g. generators); and
- Possible fugitive emissions (i.e. unexpected or uncontrolled emissions)

The main source of atmospheric pollutants from the project is the gases that are emitted when gas is burnt in the flare during flow testing. The assessment in the ES quantifies the amount of nitrogen dioxide, benzene and radon that could be emitted from the flare and how it would be dispersed using weather data for the prevailing wind directions.

The predicted air quality emissions from the project have been compared to Air Quality Objectives and Limit Values for the different pollutants likely to be emitted by the project activities (Section 6.7 of the ES). These objectives and limit values are based on minimizing health effects as a result of acute or chronic exposure to potentially sensitive individuals.

Dust

The applicant concludes that given that the site is located within an area of agricultural land and has not been subject to historical development there is a negligible risk of contaminated dust being generated during the construction of the well pad, access track, extended flow testing infrastructure, gas pipeline and the seismometer arrays.

The risk to nearby receptors has been assessed by the applicant. This assessment has concluded that there is a negligible to low risk of dust being created by the project and it will not result in a significant effect. This is because there is sufficient

distance between the site and potentially sensitive receptors. Furthermore, the scale and duration of the project activities (construction of the access track and well pad and decommissioning) will not be carried out over a long period of time (less than 2 months for each activity).

Emissions from generators

The applicant has provided details of equipment that will be used at the site, i.e. pumps, fracturing water transfer pumps, generators, blender units and service rigs. The equipment will be used during the drill phases for the duration of the drilling. During the hydraulic fracturing the engines will be run for only a few hours at a time. Given the size of the generators and engines and the relatively short period of operation, these sources have been scoped out of the assessment by the applicant. A table summarising the generators used on site is provided in Appendix F of the ES.

Further information was requested from the applicant to justify the decision to remove the generators from the scope of the assessment. This has been provided and provides sufficient information to justify the applicant's conclusion.

Emissions from road traffic

To assess the impacts from road traffic an initial screening exercise was undertaken by the applicant that examined the likely changes in vehicle numbers on the road and compares these with criteria from the national guidance 'Design Manual for Roads and Bridges' (DMRB) to determine whether a more detailed assessment was required. The criteria are not exceeded so no significant air quality impacts are likely, according to the applicant's assessment.

Again, further information was requested to justify this decision and this has been provided and provides sufficient information to justify the applicant's conclusion.

Emissions from the Flare

The Air Quality chapter of the ES (Chapter 6) includes a forecast and assessment of the potential quantity and effects of NORM in the form of gas (specifically radon) that may be present in the gas that is burnt in the flare stacks. These predictions have been compared to an annual dose limit of 300 microSv/yr for a single source. The predicted emissions from the combustion of gas in the flares is 0.3 microSy/yr. This is one thousand times lower than the International Commission on Radiological Protection (ICRP) limit. Therefore, the applicant concludes, the levels of NORM emitted to the atmosphere by the project do not present a significant risk to health.

The flares that will be used to burn gas generated during initial flow testing are the main source of emissions to air associated with the project. The concentrations and distribution of pollutants (specifically NO2 and benzene) have been modelled by the applicant so that the effect on air quality, and indirectly health, can be predicted at potentially sensitive receptor locations around the site (residential properties). The ES air quality assessment concludes that the levels of NO2 and benzene are well within the regulatory limits and therefore do not present significant risk to health.

The air quality effects from the project have been assessed. The assessment by the applicant for all of these parameters has concluded that the emissions from the project will not be significant.

Because of the low risks, the applicant says the only mitigation measures required are standard dust control measures that are used during construction of the access track, well pad and the installation of the connection to the national transmission system. According to the ES, these will be sufficient to manage the risk of the project generating dust that could adversely affect vegetation or nearby properties.

Summary of consultee comments and representations

LCC Director of Public Health: Has provided specific advice to inform the planning process and provide public health advice to protect and improve the health of local residents living near the proposed shale gas exploration sites of Preston New Road (planning application numbers LCC/2014/0096 and 0097) and Roseacre Wood (planning application numbers LCC/2014/0101 and 0102). The advice was published as a Health Impact Assessment (HIA) in November 2014. This is covered in more detail in Appendix 19.

The Health Impact Assessment makes 45 recommendations to a broad range of agencies, suggesting actions before, during and after any permissions or permits are granted. Appendix J contains 16 specific recommendations to inform this planning process.

Three of the 16 recommendations in Appendix J relate specifically to air quality as follows:

3. *Undertake an independent verification of the assessment of air quality, transport, waste management and induced seismicity prior to determining the planning applications.*

6. *Consider the need to seek further clarification from the Applicant that the cumulative impacts of the operations from the flare, generators, vehicles and drilling will not exceed the national air quality objective thresholds, particularly for PM 24 hour mean levels*

7. *As part of either the planning or permitting process, the Applicant should be required to submit regular data on the ambient air quality on site measuring all the common air pollutants relevant to the activity and report them regularly. PM10 and PM2.5 should be reported separately.*

Public Health England: has sought a number of clarifications regarding the planning application in two separate consultation responses. In turn, the clarifications and questions contained in both PHE responses have been satisfactorily addressed as a result of further information or clarification provided by the applicant.

In many cases, the applicant has clarified how and where the PHE comments are addressed in the Environment Statement submitted with the planning application, or has submitted additional information. This further information has been the subject of further consultation. Several of the clarifications requested by PHE are also controlled by the Environment Agency through the permit process.

PHE conclude that although onshore oil and gas extraction and related activities have the potential to cause pollution to air, land and water, the currently available evidence indicates that the potential risks to public health from exposure to the emissions associated with such extraction are low if the operations are properly run and regulated.

Overall, based solely on the information contained within the application provided, PHE has no significant concerns in relation to the potential emissions from the site adversely impacting the health of the local population from this proposed activity, providing that the applicant takes all appropriate measures to prevent or control pollution, in accordance with the relevant sector technical guidance or industry best practice.

PHE agrees with the proposals to undertake baseline monitoring of ground waters, surface waters and local air quality to better assess the impact on the environment from any development.

However, it says the details of the baseline monitoring prior to operations need to be provided to ensure it will allow assessment of the impact of operations on the local environment. Baseline monitoring, and on-going monitoring, is a requirement of the Environment Agency permit as set out in the Waste Management Plan (which is part of the permit). In addition, a pre-operational condition of the permit requires the applicant to obtain written approval from the Agency for an Environmental Management and Monitoring Plan (EMMP) at least 4 weeks before commencement of the gas flaring activity. This will include details of the baseline air quality study undertaken before activities commence, together with details of the ambient air monitoring programme proposed during and after the period of gas flaring.

PHE say the levels of radon are very small and there are no grounds for concern about the potential radiological impact of radon arising from the proposed activities. Similarly, on naturally occurring radioactive material (NORM) PHE confirm the dose is significantly below PHE's recommended level and is not a concern.

Fylde Borough Council: objects to the proposal. The Borough Council believes operations would be in relatively close proximity to residential properties and the noise and general disturbance from 24 hour drilling operations and associated activity would be significant. The Borough Council says the proposal is contrary to the provisions of Policy DM2 of the Minerals and Waste Local Plan and Policies EP26, EP27 and EP28 of the Fylde Borough Local Plan which are considered to be in conformity with the provisions of the National Planning Policy Framework.

In terms of air quality, the Borough Council states the increase in road traffic is unlikely to approach the “action” level of 40µg/m³ but the area will see a rise in air pollution albeit not very significant but due to low current levels there will be a

significant percentage increase. It is the Borough Council's intention to relocate one of the NOx tubes that is used to monitor road traffic pollution in another area to this location.

In addition, the Borough Council requests that the applicant shall ensure that there is continuous monitoring of air quality as a result of increase road traffic to demonstrate that air quality guidelines are being met.

Dust – the site has been categorised as "medium" with reference to likelihood of dust creation and dispersal. Due to the sensitivity of the environment and the residents the Borough Council advise that the site is categorised as "large".

Westby-with- Plumptons Parish Council: Recommends the application be refused. Among a range of objections, the parish councils believes air pollution to any degree is unacceptable

Kirkham Town Council: Object to the proposed exploration activities as a whole and are of the view that the benefits are outweighed by the potential major problems relating to air quality among a range of issues.

Medlar-with-Wesham Parish Council and Kirkham Town Council: Object to the proposal as submitted and requests that it be refused planning permission for the following air quality related reason: Air pollution from gas emissions. Flaring can lead to over 250 pollutants including methane.

Friends of the Earth: have made several representations. On air quality, the following issues are raised:

- The project has adverse air quality impacts which have consequences for people and children.
- Local planning authorities should check the impacts against background (baseline) air quality
- The applicant's air quality assessment does not identify vulnerable groups that might be affected at a caravan park (1.2km away) and school (1.5km away). These groups experience impacts differently.
- The applicant has scoped out of the assessment the Blackpool air quality management area approximately 5km away
- The applicant has scoped out of the assessment the generators and site equipment which emit gases.
- The project will increase emissions to air in absolute terms, yet no mitigation is provided.
- Representations that statutory Air Quality reduction targets for PM2.5 will not be met, where schedule 7 defines a reduction target of PM2.5>8.5µg/m3.
- Radon is emitted from the flares.
- The health impacts from air pollution have recently been identified by the charity Medact.

Roseacre Awareness Group: While the Roseacre Awareness Group's comments on air quality relate to the Roseacre Wood application, they can equally apply to the

Preston New Road site. Comments were made in relation to particulate matter (PM2.5):

- It is suggested the ES provides no specific modelling of PM2.5
- There is criticism that national targets are not referred to
- An estimate is made of the annual emissions of PM2.5
- The health impacts associated with PM2.5 are described.

Other Representations: The following is a summary of the issues raised in representations that relate to air quality:

- Proposal will result in greenhouse gas emissions / air pollution
- Proposal is contrary to Policy EP26 due to flaring and air quality impacts
- Flared methane emissions from fracked gas are worse than from coal
- It is estimated that up to 7.9% of methane from shale gas escapes to atmosphere from venting and leaks over the lifetime of a well.
- In the USA, the methane emissions from shale developments were up to 1000 times higher than initially reported.
- Flaring of methane 24hrs a day is not clean energy
- The proposal is contrary to Article 4 of the mining waste directive which requires that the best available technique for the management of waste should be used e.g. green completion.
- In the US, the Environmental Protection Agency (EPA) requires use of green completion technology from 2015 for hydraulically fractured wells instead of flaring to reduce air pollution.
- The description of the proposed flare is unclear
- Flare flume dispersal modelling should be a priority
- Flaring within 230m of a residential property is not acceptable
- Fracking will unleash radon, methane, toxic gases, particulate matter and carcinogenic toxins into the atmosphere with associated health risks
- Radioactive products will be released into environment, and will affect drinking water and food production.
- Radon should be treated as a hazardous waste
- Potential impact from air pollution to Westby reservoir and watercourses
- Fumes from the flare will concentrate toxic air pollution, which will be detrimental to local residents, including those at the caravan park.
- Air pollution will impact people and particularly those with existing illnesses, breathing disorders and low immune systems.
- Gas flaring is hazardous and will cause fires in homes
- Impact of 100 lorries per day will release carbon monoxide and carbon dioxide
- Waste fluid left in open air pits to evaporate will release harmful VOC's (volatile organic compounds) into the atmosphere
- The development will increase nitrogen dioxide levels and increase health risks to local residents
- If boreholes are not sealed properly there will be fugitive gas emissions.
- Is Cuadrilla being made to fit special filters to machines, diggings, chimneys, diesel generators etc?
- Need air quality monitoring for Great Plumpton given the prevailing wind and likely negative impacts

- Residents sought rural environment for clean air and now at risk of adverse effects
- Negative impact from air pollution on enjoyment of property, garden and living in Great Plumpton
- Emissions should be monitored with limits and fines for exceeding
- There will be an unacceptable level of dust generated

Policy

As part of the National Planning Policy Framework, planning practice guidance on various topics has been published. In relation to air quality, the guidance refers to the significance of air quality assessments to determine the impacts of proposed developments in the area and describes the role of local plans with regard to air quality. Paragraph 5 sets our considerations on whether or not air quality is relevant to a planning decision, stating this will depend on the proposed development and its location. Paragraph 9 sets out a flow chart to be followed in the development management process.

Policy DM2 of the JLMWLP states that development for minerals operations will be supported where it can be demonstrated that all material social, economic or environmental impacts that would cause demonstrable harm can be eliminated or reduced to acceptable levels. In assessing proposals account will be taken of the proposal's setting, baseline environmental conditions and neighbouring land uses, together with the extent to which its impacts can be controlled in accordance with current best practice and recognised standards.

Assessment

Overview of air quality impact.

Lancashire County Council Scientific Services (LCCSS) carried out a review of the air quality chapter (including radon) of the Environmental Statement.

The review concluded that the documents provide sufficient detail to show that the applicant has carried out the assessment in a satisfactory manner and that the conclusions drawn from the assessment are valid.

The review found that the documents for both sites identified the following emissions from the activities before, during and after operations: fugitive dust, nitrogen oxides and particulate matter, volatile organic compounds (VOCs) and odours.

The review suggested there are other potential pollutants not mentioned in the assessment which may adversely affect air quality. These include sulphur dioxide, hydrogen chloride and other potentially carcinogenic VOCs. It was suggested that the assessment should explicitly consider these chemicals, but if the consideration concludes these chemicals are of little or no concern this should be confirmed. Further information has been provided by the applicant in relation to these points:

Sulphur Dioxide & Hydrogen Chloride

Results of testing of gas from Cuadrilla's Preese Hall well did not detect any sulphurous compounds or chlorine compounds in the gas. It is therefore assessed as very unlikely that there will be any significant concentrations of sulphur dioxide or hydrogen chloride in the gas produced at the proposed site. The applicant concludes that the contribution of sulphur dioxide is insignificant.

Sulphur dioxide (SO2) has not been included in the assessment; the Applicant provided information based on other gas extractions locally that no hydrogen sulphide (H2S) has been identified during monitoring of the drilling muds or the gas. A sulphurous gas, carbonyl sulphide, has been found to be present in gas extracted from Preese Hall exploration site, prior to combustion.

Using the data for carbonyl sulphide (9ppb), the Environment Agency has calculated a sulphur dioxide, (SO2) emission rate, assuming 96% destruction during combustion (expected efficiency about 98%).

On this basis the Agency predicted the sulphur deposition at all ecological receptors and its contribution to acid deposition and have concluded that the contribution from SO2 is likely to be insignificant (as suggested by the applicant's data). Therefore the Agency did not consider it necessary to require the applicant to calculate sulphur deposition in their acid deposition predictions at statutory sites.

Monitoring of the gas quality will be undertaken once the site is operational. This will mitigate the risk of any unexpected pollutant emissions going undetected. In addition, the EA permit requires the applicant to undertake ambient air monitoring for comparison against a baseline.

VOCs

The air quality assessment has identified the most significant VOCs (volatile organic compounds) as benzene and benzo-a-pyrene (BaP) (selected to represent carcinogenic VOCs). The main pollutants of concern which are included in the air quality objectives are benzene and BaP (Benzo-a-pyrene). The benzene results are included within the ES, section 6.7.5.

BaP: Due to limited amounts of information on polycyclic aromatic hydrocarbons (PAHs) being available in the UK, for the assessment at Preston New Road a precautionary approach has been taken by the applicant by making assumptions based on data from Alberta, Canada. The information has been used to determine the emissions of BaP that could potentially result in a breach of the UK objective for BaP (0.25ng/m3 annual mean).

Analysis undertaken by M.Strosher et al looking at the composition of flare gas from natural gas extraction sites in Canada has been used by the applicant for the assumptions made for the Preston New Road site, which in discussion with the Environment Agency is considered the best source of information regarding BaP content of shale gas.

The applicant has made a worst case assumption for the Preston New Road site in the ES (chapter 6) that assumes that C6 hydrocarbons constitute 0.1% of the total emissions. The Alberta report indicates that BaP is around 1/1000th of the amount of Benzene. Using this as the worst case assumption, the potential contribution from the Preston New Road site can be calculated. Based on this approach the highest predicted annual mean concentration is 0.0224 ng/m3 which is well below the UK objective (0.25ng/m3). In summary, the findings in the ES and the further information submitted by the applicant conclude that the risk of any impacts of VOCs emissions from the flare on local receptors would be not significant. In addition, the EA permit (which incorporates the Waste Management Plan) requires ambient monitoring of VOCs and BTEX (benzene, toluene, ethylbenzene, and xylenes) and indirect monitoring of the flare of VOCs among other chemicals.

Particulate Matter (PM10 and PM2.5)

The applicant submitted further information on particulate matter (PM10 and PM2.5) and assessed the impact on air quality as insignificant. This was the subject of further consultation and has attracted criticism from local opposition groups.

The County Council commissioned specialist air quality advice from Ricardo-AEA to assess the applicant's information and predictions, together with the concerns raised by objectors in relation to particulate matter.

For PM10 the results indicate no receptor is likely to experience a change of greater than, or equal to 1% of the annual mean objective (40µg/m3) as such no significant effects are likely to result from cumulative impacts. The total concentrations are also well below the air quality objectives for PM10.

For PM2.5 the total cumulative impacts from generators and traffic have been added together. The results indicate all predicted concentrations remain well below the annual mean air quality target for PM2.5 (25µg/m3). Given the low concentrations of PM2.5 in the area and following the additional PM2.5 concentrations predicted at sensitive receptors it is concluded there are no significant impacts as a result of the proposed development. The PM2.5 target for annual mean is a health based target, therefore the proposed development should not have an impact upon human health.

The generator model input parameters have been checked against European Monitoring Evaluation Programme European Environment Agency (EMEP-EEA) Emission Inventory Guidebook emission factors (Ref. 2 Table 3-2 “Tier 2 emission factors for off-road machinery”). The model input parameters were found to be reasonable.

An objection has been made suggesting there is no specific modelling of PM2.5 in the ES. It is argued the dispersion characteristics differ significantly from PM10 and therefore the results of ARUP's PM10 modelling are not relevant to PM2.5. This suggestion is a misleading. The dispersion characteristics of PM2.5 do differ slightly from those of PM10, but only in terms of (a) secondary formation processes in the atmosphere which are not relevant in relation to local impacts, and (b) more rapid deposition of PM2.5 compared to PM10. As deposition of PM10 and PM2.5 was not taken into account in the assessment (to provide a conservative basis for the study),

this aspect is not relevant to the assessment of model results for PM10 versus PM2.5.

There is an objection that refers to the National Exposure Reduction targets, and criticises the Environment Agency for not referring to the these targets in the "H1 Annex F – Air emissions" document. The reason why the National Exposure Reduction targets for PM2.5 are not included in H1 is that emission reduction is a national strategy, not a local responsibility. Consequently, if an individual development does not contribute to national emissions reduction, this does not constitute a reason for refusal for the proposed development.

Statutory Instrument 2010 No. 1001 ("The Air Quality Standards Regulations 2010") sets out the calculation methodology for compliance. This prescribes the measurement must be from average annual measurement must be derived from measurements at all the sampling points in urban background locations which have been installed in accordance with Section B of Annex V to Directive 2008/50/EC; and the average annual measurement must be averaged over three calendar years (23(2) (a) and (b)). It is clear the calculation of compliance or otherwise with the National Exposure Reduction target is a national calculation, not a local one.

A lengthy objection uses a rough calculation to suggest an increase in PM2.5 emissions in the local area of 7% to 28%. This is based on an estimated annual emission from Roseacre Wood site of 9.25 tonnes, which is reasonably consistent with the data in the applicant's assessment of PM2.5. The calculated increase in PM2.5 emissions is broadly consistent with the findings of the additional assessment of PM2.5 carried out by the applicant, which suggested an increase of up to 4% in levels of PM2.5 compared to baseline.

However, the subsequent use of this information in the objection is misleading and erroneous because it discusses changes in emissions of particulate matter in relation to the number of additional deaths. This is incorrect as the change in emissions gives no information on the change in exposure to PM2.5. It is exposure to PM2.5 (ie the PM2.5 concentration) that is important, not the change in emissions. It is implied that the percentage in emission rate locally could be considered throughout Lancashire. This is incorrect as the exposure of almost all of the population of the county will not change significantly as a result of the proposals. It also ignores the fact that the vast majority of PM2.5 in the atmosphere comes from other sources. The other important point to note is that in a rural area where there is very little activity (and hence very low emissions of PM2.5), the introduction of a new source of pollutant will inevitably result in what appears to be a high percentage increase in emissions. Extrapolating this percentage increase to the whole of Lancashire is incorrect and misleading.

Emissions from construction activities

Because the site is located within an area of agricultural land and has not been subject to historical development there is a negligible risk of contaminated dust being generated during the construction of the well pad, access track, extended flow testing infrastructure, gas pipeline and the seismometer arrays.

The risk to nearby receptors has been assessed by the applicant. This assessment has concluded that there is a negligible to low risk of dust being created by the project and it will not result in a significant effect. This is because there is sufficient distance between the site and potentially sensitive receptors. Furthermore, the scale and duration of the project activities (construction of the access track and well pad and decommissioning) will not be carried out over a long period of time (less than 2 months for each activity). Nevertheless, if planning permission is granted the risk of dust emissions should be controlled through a condition requiring a dust management plan.

Emissions from the vehicles associated with the use of the site

Environmental Protection UK (EPUK) provides guidance (Development Control: Planning for Air Quality, 2010) to help establish when an air quality assessment is likely to be considered necessary because a proposal might cause a significant change in air quality. Environmental Protection UK is a national charity that provides advice on air quality and their effects on people and communities.

For emissions from vehicles, the following guidance is provided.

- *Proposals that will give rise to a significant change in either traffic volumes, typically a change in annual average daily traffic (AADT) or peak traffic flows of greater than ±5% or ±10%, depending on local circumstances (a change of ±5% will be appropriate for traffic flows within an AQMA), or in vehicle speed (typically of more than ±10 kph), or both, usually on a road with more than 10,000 AADT (5,000 if 'narrow and congested');*
- *Proposals that would significantly alter the traffic composition on local roads, for instance, increase the number of HGVs by say 200 movements or more per day, due to the development of a bus station or an HGV park (professional judgement will be required, taking account of the total vehicle flow as well as the change);*

The applicant has used this guidance to assess the significance of vehicle emissions on air quality. A significant effect would occur if the number of HGVs was to increase by 200 or more per day, or the overall traffic flow was to increase by more than 1,000 vehicles per day.

Construction: Vehicle traffic movements during the construction phase reach a worst case maximum of approximately 34 average annual daily traffic (AADT) movements (approximately 12 cars or vans and 22 HGVs). Following the EPUK guidance (which states the number of vehicles required in order to trigger the need for a detailed assessment - an increase in HGVs by 200 or an increase in total AADT by 1000) it is clear the number of vehicles is well below the thresholds which would require a detailed assessment. It is therefore concluded that the air quality impacts of exhaust emission from vehicles in the construction phase is not significant.

Drilling: Vehicle traffic movements during the drilling phases reach a worst case maximum of approximately 45 AADT (32 cars or vans and 13 HGVs). Following the EPUK guidance which states the number of vehicles required in order to trigger the

need for a detailed assessment (an increase in HGVs by 200 or an increase in total AADT by 1000) it is clear the number of vehicles is below the thresholds which would require a detailed assessment. It is therefore concluded that the air quality impacts of exhaust emission from vehicles in this phase is not significant.

Initial flow testing: The maximum impacts on air quality will take place during the initial flow testing stage (from the flare). Traffic flows in this phase are well below the level which would require a detailed assessment. The impact from vehicle movements during this phase is therefore considered not significant. This would also apply if greater than anticipated flowback rates were encountered because the maximum number of daily vehicle movements is significantly less than the 200 HGVs or 1000 vehicle movements per day threshold.

Extended flow testing: No significant air quality impacts are expected as a result of the construction phase for extended flow testing. Limited vehicle movements will occur during this phase of activity, these movements will have a negligible effect on air quality and therefore are not significant.

Decommissioning and restoration: Extended Flow Testing Infrastructure; limited vehicle movements will occur during this phase of activity so there are no significant effects on air quality. Exploration well, pad and access track; decommissioning the well pad and access track will require the same number of vehicle movements as during construction so the air quality impacts of exhaust emission from vehicles is again not significant.

Emissions from the flaring of gas during flow testing

Environment Agency assessment

The Environment Agency (EA) has undertaken its own detailed assessments of the emissions to air that will arise from the flow testing operations (i.e. from the flare) and the potential impact of these emissions on human health and ecological receptors.

Detailed air dispersion modelling has been carried out by the EA. This considered the potential impacts of the main pollutants that could be emitted from the combustion of natural gas based on its expected composition:

- Oxides of nitrogen / nitrogen dioxide
- Benzene (a volatile organic compound)
- PAH emissions (a reference to benzo-a-pyrene)

Particulate emissions have been covered by a qualitative assessment as the EA would not expect particulate (PM10) to result from gaseous emissions.

Sulphur dioxide (SO2) was not included in the EA's assessment because the applicant provided information based on other gas extraction locally that no hydrogen sulphide (H2S) has been identified during monitoring of the drilling muds or gas.

Having undertaken a detailed assessment, the EA is satisfied that the emissions from the flare would be insignificant at locations closest to the site.

In terms of public health impact of the flare emissions, the EA's audit checks, modelling and sensitivity analysis confirms there will be no exceedance of standards established for human protection. Indeed, the modelling assumed the flares would be operating for 24 hours, 365 days per year per well. The actual proposal is for the flares to operate for no more than 90 days per well.

Public Health England assessment

PHE conclude that although onshore oil and gas extraction and related activities have the potential to cause pollution to air, land and water, the currently available evidence indicates that the potential risks to public health from exposure to the emissions associated with such extraction are low if the operations are properly run and regulated.

Based solely on the information contained within the application provided, PHE has no significant concerns in relation to the potential emissions from the site adversely impacting the health of the local population from this proposed activity, providing that the applicant takes all appropriate measures to prevent or control pollution, in accordance with the relevant sector technical guidance or industry best practice.

PHE agrees with the proposals to undertake baseline monitoring of ground waters, surface waters and local air quality to better assess the impact on the environment from any development.

Emissions from equipment associated with the operation of the site (e.g. generators)

In the Environment Statement (ES), the applicant provided details of equipment that will be used at the site, i.e. pumps fracturing water transfer pumps, generators, blender units and service rigs. The equipment will be used during the drill phases for the duration of the drilling. During the hydraulic fracturing the engines will be run for only a few hours at a time. Given the size of the generators and engines and the relatively short period of operation, these sources were scoped out of the assessment by the applicant. A table summarising the generators used on site is provided in Appendix F of the Environment Statement.

However, the County Council requested the applicant to undertake a further assessment to demonstrate (and justify) the exclusion of the generators from the air quality assessment in the ES. This assessment was undertaken and the information provided by the applicant was subject to a further round of public consultation.

The further assessment included detailed dispersion modelling to assess the impacts from the generators and the vehicle movements to/from the site. A number of worst case assumptions have been made in the modelling to ensure a conservative approach has been taken. The modelling shows that no significant effects are likely to result.

Further corroboration of the conclusion that no significant effect is likely from PM10s is demonstrated by the generators being below the threshold of local authority

regulation. Fylde Borough Council has confirmed this is the case. This is a result of the Environmental Permitting (England and Wales) (Amendment) Regulations 2014/255. The amendment removes the need for the aggregation of diesel generators with a rated thermal input of less than 3 megawatts:

The modelling shows the PM10 24 hour mean level (50 ug/m3) is not breached on any day of the year. The national standard (24 hour mean, 50 ug/m3) allows for 35 breaches per year (90.4 percentile).

The operation of the generators is not part of the activities controlled by the EA permit. However any emissions from the generators when operational, would contribute to overall background levels which could be identified during ambient air monitoring. The flares will operate for no more than 90 days at a time for each well, and there may be short periods where the flares and the generators would be operating concurrently. Flaring is limited to 130,000 cubic metres per day.

The existing background levels that the EA use for comparison are relatively low and it is satisfied that the short term operation of the generators will not contribute to the background levels in a way that any air quality Health Based Standards will be breached by the emissions from the flares. Ambient air monitoring will be included in the EMMP which must be approved by the EA prior to flaring operations commencing and be implemented by the Operator. Should the generators be in use at this time, the results will demonstrate the level of impact they have on air quality.

Possible fugitive emissions (i.e. unexpected or uncontrolled emissions)

The EA permit requires that during drilling of the exploratory boreholes, fugitive emissions of natural gas are to be prevented by increasing the hydrostatic pressure of fluids so as to prevent gas release. The well will also be equipped with physical control equipment which enables the borehole to be shut at the surface to prevent escape of gas emissions. Gas monitoring equipment will be in constant use at the surface. The permit does not allow the venting of natural gas unless it is necessary for reasons of safety in an emergency.

Fugitive emissions of methane could potentially arise from the wellbore and mud circulation system. The applicant has provided a specific risk assessment for this scenario, which includes monitoring and proposes emergency control measures. The operator will carry out testing of all surface pipework to check for leaks prior to starting the operations and will be carrying out monitoring using Flame Ionization Detection monitoring equipment during the operations as part of the Environmental Management and Monitoring Plan required by the permit.

The operations will be benchmarked against baseline levels and should elevated levels of methane be detected, the well will be shut and the cause of the damages investigated and remedied. Operation will only resume once the EA is satisfied that the issue has been resolved.

The EA is satisfied that these measures minimise the risk of fugitive emissions and, together with condition 3.1 of the permit, provide acceptable controls.

Particulate matter (PM10) emissions

The County Council's Director of Public Health has made two recommendations that relate specifically to emissions of particulate matter (PM10). These are recommendations 6 and 7 from appendix J of the Health Impact Assessment. An assessment has therefore been carried out in relation to PM10s.

PM10 from generators and vehicles:

An assessment of PM10 (particulate matter of 10 microns diameter or less) from generators and vehicles has been undertaken and presented for both the Preston New Road and the Roseacre Wood proposed exploration sites as part of a further information request to the applicant. Detailed dispersion modelling has been used to assess the impacts from the generators and the vehicle movements to/from the site. A number of worst case assumptions have been made in the modelling to ensure a conservative approach has been taken. The modelling shows that no significant effects are likely to result.

Further corroboration of the conclusion that no significant effect is likely from PM10s is demonstrated by the generators being below the threshold of local authority regulation. Fylde Borough Council has confirmed this is the case. This is a result of the Environmental Permitting (England and Wales) (Amendment) Regulations 2014/255. The amendment removes the need for the aggregation of diesel generators with a rated thermal input of less than 3 megawatts: Schedule 1 (activities, installations and mobile plant)

In order to calculate the total cumulative impacts from generators and traffic the scheme related concentrations are added together. The findings from this cumulative assessment of PM10 for the Roseacre Wood and Preston New Road site during operations are that the results indicate no receptor is likely to experience a change of greater than, or equal to 1% of the annual mean objective (40µg/m3). As such no significant effects are likely to result from cumulative impacts. The total concentrations are also well below the air quality objectives for PM10. In other words, the assessment shows the PM10 24 hour mean level (50 ug/m3) is not breached on any day of the year. The national standard (24 hour mean) allows for 35 breaches per year (90.4 percentile).

PM10 from Flaring

The generation of PM10 emissions from the flare has been scoped-out of the assessment due to the gas composition and high efficiency of combustion. This has been agreed with the EA and is described in the permit:

> "*Particulates have been covered by a qualitative assessment as we would not expect PM10 to result from gaseous emissions. It formed part of the air quality assessment submitted by the applicant and is included in the habitats section for completeness".*

Indeed the EA has further clarified its position in relation to particulates from flaring of natural gas in that when there is full and efficient combustion (based on

temperature and retention time) the emissions are not likely to contain particulate matter.

An enclosed flare, which is a requirement for these activities, allows more control of the process, and the temperature can be continuously monitored along with the retention time to ensure the combustion process is complete. The gas flow to the flare and the gas composition are also measured.

In this case the applicant will produce an Environmental Management and Monitoring Plan before they are operational which will need to be approved by the EA; this plan will contain details of appropriate control measures they will put in place should efficient combustion not be achieved.

PM10 from Drilling

No PM10 emissions from drilling would be expected as the material drilled would be wet. Also any dust-creating processes on site would be mitigated by following the site Environmental Operating Standard (see ES: 4.13.1 & Appendix E).

Air Quality Monitoring

The EA permit requires, through the Waste Management Plan, monitoring of 13 ambient air quality parameters including PM2.5 and PM10. This will be done prior to operations commencing to establish a baseline, during operations and after operations have ceased. Four sampling positions will remain constant at the perimeter of the site. The parameters are: methane, carbon monoxide, hydrogen sulphide, nitrogen dioxide, nitrogen monoxide, sulphur dioxide, ozone, total petroleum hydrocarbons, VOCs, BTEX, PM2.5 and PM10, dust. Results will be published monthly and submitted to the Agency for check and verification.

Monitoring of particulates will be undertaken throughout the operational period of the site using Frisbee-type dust gauges with directional adhesive strips (for nuisance dust) plus pumped gravimetric sampling for PM10 and PM2.5 will be located at four locations in close proximity to key receptors. The sampling period for gravimetric monitoring for PM10 and PM2.5 will be 24 hours.

In addition, the EA requires point source emission monitoring from the flare for oxides of nitrogen, carbon monoxide, total volatile organic compounds, and methane (using emission modelling calculations) as part of the permit.

In summary, no significant effects are expected daily or annually from PM10s for any phase of the project, or in combination of phases. Moreover, the EA provides for ambient PM10 and PM2.5 monitoring over 24 hour periods.

Conclusion

The County Council commissioned Lancashire Scientific Services and Ricardo-AEA to assess air quality impacts. The EA has undertaken an extensive assessment of air quality impacts.

The project would generate some emissions to air. But providing the operational practices are adhered to and regulated by the EA, the emissions would not cause unacceptable impacts. .

No particulate matter (PM2.5 or PM10) concentrations are predicted to exceed the target levels and the impact from operational phase works will be insignificant. In order to confirm these modelled predictions during operation, monitoring will be undertaken by Cuadrilla using the same gravimetric sampling method that is being used currently to assess the baseline.

Having undertaken a detailed assessment, the EA is satisfied that the emissions from the flare would be insignificant at locations closest to the site. In terms of the public health impact of the flare emissions, the EA's audit checks, modelling and sensitivity analysis confirms there will be no exceedance of standards established for human protection.

Based on the information contained within the application, Public Health England has no significant concerns in relation to the potential emissions from the site adversely impacting the health of the local population, providing the applicant takes all appropriate measures to prevent or control pollution, in accordance with the relevant sector technical guidance or industry best practice

Comprehensive monitoring of the practices and the site, overseen and regulated by the EA, will ensure that risks are managed effectively.

The proposal would not have unacceptable air quality impacts and would comply with national guidance and policies, together with the policies of the development plan.