ARUP

Subject Cuadrilla PM2.5

Date 4 March 2015

Roseacre Wood Exploration Site Application – LCC/2014/0096 – Planning and Environment meeting request - Air Quality Response

This note has been prepared in response to the following request set out in a request for further information in a letter dated 26th February 2015 from Lancashire County Council in relation to the Roseacre Wood proposed Exploration Site, as follows:

"We discussed concerns raised by the Director of Public Health and in representations about the levels of PM2.5s most particularly from the emissions of on site generators and site traffic.

He recommends that PM10's and PM2.5s are monitored separately and notes that the Environment Agency will be monitoring such. However, I am not aware that there are any thresholds against which to measure PM2.5s and what action would need to be taken when any specific level is exceeded. I would be grateful if you could confirm what levels of PM2.5's can be expected, what monitoring would be carried out and what the impacts of PM2.5's would be and what action will be taken to ensure they are minimised to avoid any unacceptable impacts."

Introduction

An air quality assessment detailing the PM_{10} impacts at local sensitive receptors was undertaken following a Regulation 22 request. This assessment builds upon that information to detail the predicted $PM_{2.5}$ concentrations as a result of the operational phase of the development.

Methodology

As requested we have carried out an assessment of $PM_{2.5}$ from all the main sources in use during the operational phase of the development (generators and vehicles).

It is not necessary to include emissions from the flare and drilling for the following reasons. The flare has been assessed as generating no particulate matter (PM) due to both the gas composition and high efficiency of combustion. This has been reviewed by and agreed with the Environment Agency. In addition no PM emissions would be generated from the drilling operations as the material generated during drilling would be wet. Also any dust creating processes on site would be mitigated by following the site environmental management plan.

Detailed dispersion modelling has been used to quantify any potential 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 and details of these are provided below. For this assessment all particulate matter emitted from the traffic or generators has been assumed to be in the form of $PM_{2.5}$ this is a worst case assumption and one which will over estimate the total amount. This assumption means that the assessment follows the conservative approach.

Subject Cuadrilla PM2.5

Date 4 March 2015

Generators

The same meteorology data, receptor locations, background pollutant concentrations and significance criteria have been used as within the main ES chapter (and subsequent appendix).

The generators used on site as detailed within the ES appendix are shown in Table 1.

Table 1 Generators used on site

Activity	Generators	Active time
Drilling	3 x Pramac GCW1500-50L, Diesel Engines, MTU 12V4000G23 3B	24hrs during drilling
Hydraulic Fracturing	1 x Twin Caterpillar C-13 520 bhp engines	<12hrs
	6 x Caterpillar 3512C 2,500 bhp engines	<12hrs
	1x Caterpillar C-13 520 bhp engine	24hr during hydraulic fracturing
Other processes	1x Perkins 1104CTA diesel engine	<12hrs
	2x Caterpillar C-9 350 bhp engines	<12hrs
	1x Caterpillar C-13 520 bhp engine	<12hrs
	1x Caterpillar C-13 engine	<12hrs

The generator inputs to the model are detailed below. The 'very large generators' represent the 2500bhp, the 'large generators' represent the 520bhp engines and the 'small generators' represent the 230bhp and 350bhp engines.

Table 2 Generator input data

Parameter	Unit	Large Generator	Medium generator	Small generator
OS grid reference	m	337354, 432644	337354, 432644	337354, 432644
Power	HP	2500	540	250
Stack Temp	^{o}C	535	535	454
Exit velocity	m/s	15	15	15
Stack height	m	4	2	2
Stack diameter	m	0.61	0.37	0.24
$PM_{2.5}$ emissions[1]	g/s	0.104	0.022	0.010

To model the generator impacts one very large, one large generator and one small generator were included in the model (at the grid references detailed in **Table 2**) and the predicted emissions were then factored up based on worst case assumptions as follows:-

The large generators were assumed to run for the following times;

- 6 very large generators running 12hrs per day during Hydraulic Fracturing.

[1] Emissions based on non road mobile machinery emissions regulation limits from Directive 97/68/EC and in UK law 'Non road Mobile Machinery (emission of gaseous and particulate pollutants) regulations 1999 (SI 1999/1053), PM_{10} 0.2g/kW/hr. In 2015 Stage V standards will be in place and the PM_{10} emissions would need to meet these lower standards so results would be lower than predicted here.

The medium generators were assumed to run for the following times;

- 3 large generators running 24 hrs per day during drilling for 90 days, twice in a 12 month period (i.e. 180 days).
- 3 large generators running 24hrs per day for one month.

The small generators were assumed to run for the following times;

- 4 small generators running for 24 hrs per day all year.

Traffic

The same meteorological data, receptor locations, background pollutant concentrations and significance criteria have been used as within the main ES chapter.

The ADMS-Roads model has been used to assess the potential $PM_{2.5}$ impact from vehicles passing local receptors. Traffic data was provided by the Arup's in house transport planning team (authors of ES chapter 18 and Appendix R1, the Transport Assessment). The maximum number of vehicles assessed for the proposed scheme during any 24hr period has been assumed to occur on every day of the year which is a significant over estimation of the actual flows. The maximum number of 32 Light Goods Vehicles (LGVs) and 13 Heavy Goods Vehicles (HGVs) were added to the base flows for the existing roads and emissions calculated using the emissions factor tool kit version 6.0.1 built into the ADMS software.

The total 'do minimum' (no proposed scheme) and 'do something' (proposed scheme is operational) scenario results were calculated and the change in concentrations as a result of scheme related traffic was calculated.

The A583 road has been used as the basis for the assessment because traffic data for this road is available and as it is the main road in the area it will therefore be the main source of traffic related pollution. The vehicles accessing the site will use this road. Only receptors along the A583 are selected as that is where the worst case scheme impacts would occur.

Cumulative Emissions

The total scheme related emissions were summed taking into account both the worst case emissions from generators and the worst case emissions from vehicles.

Subject Cuadrilla PM2.5

Date 4 March 2015

Operational results

Generators

The results of $PM_{2.5}$ concentrations at selected worst case receptors are presented below.

Table 3 Generator $PM_{2.5}$ results

Location	X	Y	Annual mean process contribution (µg/m^3)	Annual mean total including background (µg/m^3)
Roseacre Hall	343714	436794	0.21	8.8
Roseacre East	343385	436717	0.10	8.7
Boundary Farm	344190	436135	0.17	8.8
New Hall	344335	435989	0.09	8.7
Stanley Farm	344130	437121	0.06	8.7
White Carr Farm	343194	435199	0.01	8.6
North Greenhills	342282	435969	0.01	8.6
Higham Nook	344996	437108	0.04	8.7
Wyre Estuary	339309	440317	0.00	8.6

The total $PM_{2.5}$ concentrations are well below the air quality target for $PM_{2.5}$ concentrations (annual mean of 25µg/m^3).

Traffic

The results of $PM_{2.5}$ concentrations at selected worst case receptors are presented below.

Table 4 Traffic related $PM_{2.5}$ concentrations

Receptor name	X	Y	Do minimum Annual mean Road $PM_{2.5}$ (µg/m^3)	Do something Annual mean Road $PM_{2.5}$ (µg/m^3)	Scheme related $PM_{2.5}$ concentrations (µg/m^3)
Roseacre Hall	343714	436794	0.01	0.01	0.002
Roseacre East	343385	436717	0.00	0.01	0.002
Boundary Farm	344190	436135	0.00	0.00	0.000
New Hall	344335	435989	0.00	0.01	0.002
Stanley Farm	344130	437121	0.00	0.00	0.000

The additional $PM_{2.5}$ as a result of the scheme is extremely low with a maximum of 0.002µg/m^3, therefore this is considered to be not significant.

Cumulative Impacts

In order to calculate the total cumulative impacts from generators and traffic the scheme related concentrations are added together which provides the following results.

Table 5 Cumulative $PM_{2.5}$ results

Location	X	Y	Annual mean process contribution (µg/m^3)	Annual mean total including background (µg/m^3)
Roseacre Hall	343714	436794	0.21	8.8
Roseacre East	343385	436717	0.10	8.7
Boundary Farm	344190	436135	0.17	8.8
New Hall	344335	435989	0.09	8.7
Stanley Farm	344130	437121	0.06	8.7
White Carr Farm	343194	435199	0.01	8.6
North Greenhills	342282	435969	0.01	8.6
Higham Nook	344996	437108	0.04	8.7
Wyre Estuary	339309	440317	0.00	8.6

The cumulative results indicate all predicted concentrations remain well below the annual mean air quality target for $PM_{2.5}$ (25µg/m^3).

Given the low concentrations of $PM_{2.5}$ in the area and following the additional $PM_{2.5}$ concentrations predicted at sensitive receptors it is concluded there are no significant impacts as a result of the proposed development. The $PM_{2.5}$ target for annual mean is a health based target, therefore the proposed development should not have an impact upon human health.

Conclusion

No $PM_{2.5}$ 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 baseline.

As no significant effects are predicted no mitigation is required.