Application for variation to Padeswood Works Permit BL1096

Installation of a new Cement Mill and Rail loading facility

Contents

1. CM5 NTS Cement Mill 5 Non-Technical Summary

1.1. Cement is made to a precise recipe. At Padeswood the raw materials are mainly limestone together with sand, pulverised fuel ash (pfa) and shale. The current recipe requires the right proportions of:

Limestone	-	the main source of calcium oxide (lime)
Shale/pfa	-	the main sources of aluminium and iron oxides
Sand	-	the main source of silicon dioxide (silica)

if a successful cement product is to be produced.

1.2. Following delivery to the site, the constituent raw materials are ground together to a fine powder and heated to about 1450°C. This is accomplished by direct heating, the heat source being the kiln flame. At this temperature complex chemical reactions take place and the calcium silicates are formed. The heated material balls up into nodules, which vary in size from 50mm diameter down to dust. This is called clinker. The clinker is cooled, then ground with gypsum and limestone, to make the familiar grey powder, which is cement.

1.3. At Padeswood the clinker production capacity is greater than the cement production capacity, as the cement market has recovered from the recession it has been necessary to transport clinker to other Hanson plants from Padeswood to meet market demand. In the short term cement mills 1 and 2 were restarted but to meet long term demand new grinding capacity is required.

1.4. This variation application is for the installation of a vertical roller mill for cement grinding, three new cement storage silos and associated plant for transporting raw materials to the mill and cement from the mill to the existing and new silos. The vertical roller mill has a number of advantages over other grinding technologies, including:

- 30-50% less energy use than ball mill systems
- Reduced vibration, less wear
- Improved product quality
- Reduced water consumption

- High productivity with stable, reliable operation

1.5. Cement mill 5 will be equipped with a bag filter to collect the cement product before it is transferred to the cement storage silos. The new mill, silos and associated plant will meet all the requirements of the latest EU BAT (Best Available Techniques) conclusions. Whilst the design of the mill is different for cement production the fundamental operating principles are the same for production using a conventional ball mill. The maintenance of a vertical mill for cement production will be largely the same as for the current raw mill and coal mill. Thus Padeswood has significant experience in the operation and maintenance of this type of equipment. The proposed mill has been used for grinding blast furnace slag and following the purchase of Italcementi by Hanson's parent company HeidlebergCement this mill is no longer required at its current location in Spain. The mill and associated plant will be dismantled, transported to Padeswood and reassembled.

1.6. The new silos will be used for loading cement into rail tankers for dispatch. To enable rail loading the existing rail tracks will be moved, the expectation is that by switching cement dispatch from road to rail there will be an annual reduction in vehicle movements of over 8,000 trips per year.

1.7. The new mill will utilise part the cement mill 4 raw material storage systems, consequently upon completion of the project cement mill 4 will no longer be operational. Cement mills 1 and 2 will be mothballed and used as back up production in the event of a major failure. Cement mill 3 will remain operational.

A site plan showing the emission point for the new cement mill, a layout drawing of the development area and an elevation drawing are included in appendix 1 of this application, more detailed information and visualisations of the plant can be found in the planning application which is available on the www.hanson-communities.co.uk/en/sites/padeswood-cement-works-community-page website.

CM5 Consultation

1.8. In addition to the statutory consultation required by the Environmental permitting Regulations, Hanson Cement presented an outline of the cement mill 5 proposals at the site's liaison committee on 2 March 2017, further details were presented at the liaison meeting on 8 May 2017. As part of the planning application a 28 day pre-application consultation was held with draft copies of the various consultants reports made available to the public via the Padeswood Works website. In addition to this exhibitions were held at Buckley Town Library and Penyffordd British Legion on May 23rd and 24th respectively. There were a total of 15 visitors, 3 at Buckley and 12 at Penyffordd. Comments and concerns raised at these events have been considered and addressed in the planning and permit applications where necessary.

1.9. The company's community newsletter "Open Door" will include a feature on cement mill 5 in the summer 2017 edition. Open Door is distributed to 19,500 homes in the area surrounding the plant.

1.10. If members of the public have any concerns are want to find out more information about the mill 5 proposal they are able to arrange a visit to the Works by contacting Joanne Hodson on 01244 552501 or e-mailing Joanne.hodson@hanson.biz.

2. CM5 EMS Environmental Management System

2.1. Hanson Cement operates an integrated management system (IMS). The IMS is certified to the following standards quality ISO9001, environment ISO14001, safety OHSAS18001, energy ISO50001, Responsible Sourcing BES6001 and PAS99. The introduction of cement mill 5 will require no changes to the procedures within the management system that control the operation of the IMS or the Hanson wide corporate procedures. There may be a number of additional local procedures required that relate to specific features of the new process. As part of the operation of the IMS changes such as the installation of mill 5 are required to go through a management of change process. The management of change risk assessment for mill 5 is provided in appendix 5. The changes identified will be implemented during the construction and commissioning phase of the mill 5 project.

3. CM5 ERA Environmental Risk Assessment

3.1. The principal risk assessment methodology for managing risks are the environmental aspect assessment UKCP05 and risk assessment UCKP02 procedures, the aspect assessments essentially identify the inherent environmental impacts associated with operations and activities such as stack emissions during normal operations or emergencies such as a large oil spillage during maintenance work. The risk assessment procedure is used to assess safety environment and quality risks of activities e.g. changing a gearbox. A high level environmental risk assessment of the cement mill 5 system is presented in appendix 3.

4. CM5 Emissions

4.1. Emissions to Air

4.1.1. The only significant emission from the cement mill is particulates to air. The main release point will be the cement mill stack. There are a number of small release points associated with the transport of raw materials from the raw material store to the mill and the transport of cement from the mill to the existing and new storage silos.

4.1.2. Cement mill 5 will be equipped with a hot gas generator to provide additional heat for process reasons (see CM5 Energy below for further details) consequently there will be emissions arising from the combustion of fuel in the hot gas generator. The burner will be fired using one of the following fuels, gas oil, kerosene or processed fuel oil complying with the requirements of the WRAP/Environment Agency PFO quality protocol.

4.1.3. The emission data for the combustion gases is taken from measurements made during operation of the mill in Spain when it was being used for slag grinding. Typically the moisture in granulated blast furnace slag is around 10% thus the drying duty of the in this mode of operation is far greater than expected for clinker grinding. Grinding 100 tonnes per hour of slag at 10% moisture would require the removal of 10 tonnes of water whereas in cement grinding the moisture input is with the limestone and gypsum at typically 5% moisture in 10 tonnes of materials i.e. 0.5 tonnes per hour of moisture removal.

4.1.4. The hot gas generator is a low temperature (relative to the cement kiln) combustion process and therefore the production of thermal NO_x is unlikely, thus the NO_x emissions are likely to be the result of fuel NO_x and given the significantly lower fuel consumption the measured emissions from Spain are likely to be greater than those expected when the mill is in use at Padeswood.

4.1.5. Sulfur dioxide emissions can also be calculated on the basis of 0.1% fuel sulfur and an hourly fuel consumption of 250 kg/h this figure is the maximum hourly fuel consumption. The 0.1% sulfur content of the fuel is specification limit for kerosene, gas oil and PFO. The requirement to use the hot gas generator is likely to be significantly less than less

4.1.6. The mass release data assume the plant operates for a full 8760 hours per year at the measured emission concentrations.

Emission	Concentration mg/Nm^3	Mass release tonnes/year
Particulates	10	7
CO	3	2.1
NO_x	13	9.1
SO_2	5	3.4

Table 1 predicted emission concentrations and worst case mass releases

4.1.7. The above emissions have been assessed using the Environment Agency's H1 tool to determine if detailed modelling is required. The screening exercise has identified that detailed modelling is required for particulate emissions but is not required for the NO_x, CO and SO_2 emissions.

4.1.8. Detailed dispersion modelling was undertaken for the permit application in 2001, the emission point inventory has been updated to the current works operation and the proposed works operation with cement mill 5. A full inventory of particulate release points is included in the dispersion modelling report prepared by Gair Consulting in appendix 6. The installation of cement mill 5 will not change the emissions from the kiln system therefore the modelling work has excluded the impact of other emissions such as SO_2, NO_x and TOC from the kiln system.

4.1.9. The dispersion modelling report concludes;

“The results of this assessment indicate that the additional releases from the proposed Cement Mill 5 will not have a significant impact on local air quality.”

4.1.10. The impacts on air quality are slightly reduced as a result of the replacement of redundant equipment. The predicted impact on air quality is given in table 2 below. It is important to note that this assessments represents worst case conditions with all release points operating at their maximum permitted level for 24 hours per day 365 days per year.

Receptor	**Existing Annual Mean ($\mu g\ m^{-3}$)**	**Future Annual Mean ($\mu g\ m^{-3}$)**	**Difference ($\mu g\ m^{-3}$)**	**Difference as Percentage of AQO**
Maximum Off-site	5.6	5.1	-0.5	-1%
R1 Dyke Farm	0.32	0.27	-0.1	0%
R2 Ty Gwyn	0.39	0.33	-0.1	0%
R3 Oak Tree Farm (west)	0.80	0.74	-0.1	0%
R4 Padeswood Drive	2.5	2.2	-0.4	-1%
R5 Penyffordd West	0.82	0.68	-0.1	0%
R6 Oak Tree Farm	1.4	0.97	-0.4	-1%
R7 Ash Tree Farm	0.77	0.63	-0.1	0%
R8 Penymynydd	0.49	0.35	-0.1	0%
R9 Buckley	0.79	0.65	-0.1	0%
R10 Rhyd Farm	0.19	0.13	-0.1	0%
Air Quality Objective	*40*			-

Table 2 Predicted Annual Mean PM10 Concentrations – Existing and Future Emissions at selected receptors

4.2. BAT Conclusion 18

4.2.1. The mill filter will be a bag filter designed to meet the BAT AEL of 10 mg/Nm^3 dry.

4.3. BAT Conclusion 16

4.3.1. Fabric filters used at transfer points and other dedusting operations such as silos and loading heads will be specified to achieve 10 mg/Nm^3 or better emission performance. All these filters will be included in the works planned preventative maintenance system.

4.4. Emissions to water

4.4.1. There will be no process emissions from the mill 5 systems to water. There will be some water use for cooling compressors, drives and bearings. This water, rainwater, surface run off water from the mill 5 area will be collected in the existing works drainage network. The surface water and a very small quantity of condensate from compressors collected passes through an oil water separator into the works settling pond, this water is then returned to the works for use as cooling water. In periods of high rainfall and low production it is sometimes necessary to discharge water from the settling pond to surface water if the level in the settling pond becomes too high. This operation is unlikely to change as a result of the mill 5 installation.

4.5. Emissions to Land

4.5.1. The will be no emissions to land from the operation of cement mill 5.

5. CM5 Operating Techniques

5.1. Simple block diagrams of the existing and mill 5 operations are shown below. There will be no changes to the operation of the kiln system and clinker transport systems from the kiln to the clinker store and to the crane store.

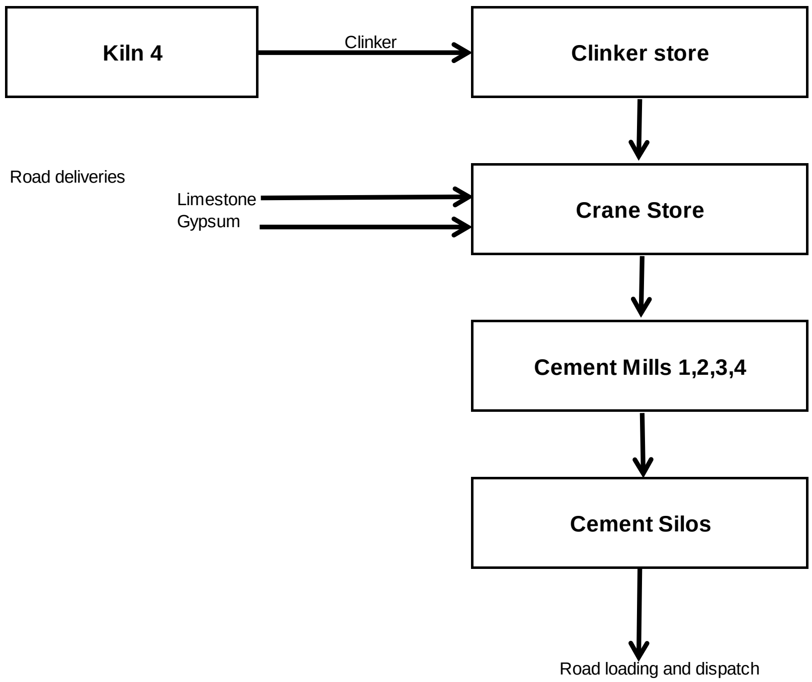

Figure 1 Existing works block diagram

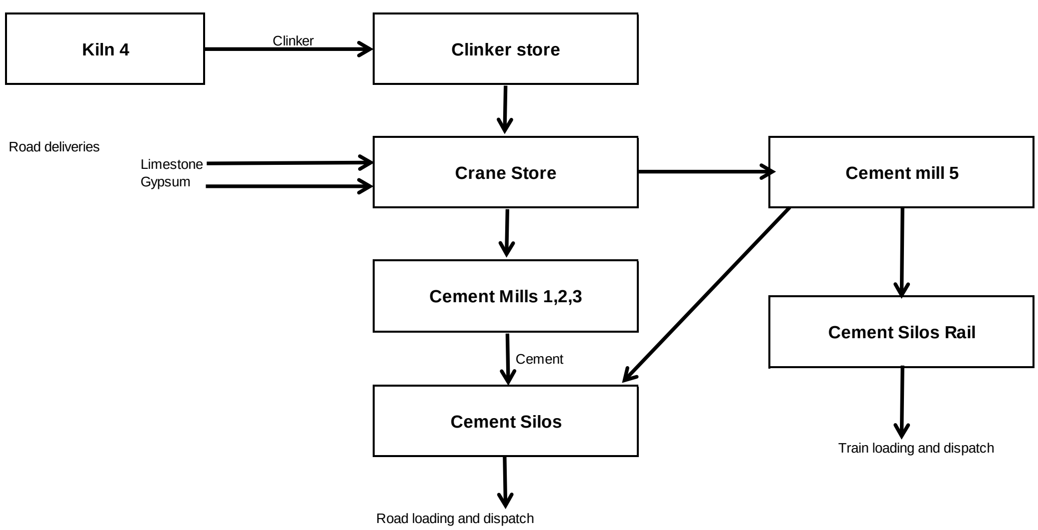

Figure 2 Block diagram with mill 5

5.2. Process Description Material Handling and Milling

5.2.1. A new material feed system will be installed in order to transport materials (comprising mainly of gypsum, clinker and limestone) from storage to Mill 5 for grinding. The raw materials will be stored in the current clinker store and existing raw material storage hall (crane store). Each material will be transferred to mill 5 via the existing Mill 4 storage hoppers. New weigh feeders will be fitted to the existing clinker and gypsum hoppers and the existing limestone weigh feeder will be upgraded.

5.2.2. The raw materials will be transported to the mill 5 building using a “Sicon” tube conveyor from the mill 4 hoppers on the south side of the crane store through an over ground tunnel within the material store at ground level. After the tunnel on the north side of the raw materials storage hall the mill feed conveyor rises to the mill 5 building in an enclosed gantry.

5.2.3. The ‘Sicon’ conveyor belt has the capability to incline and turn without the requirement for transfer points thus minimising the potential for fugitive dust emissions when handling dusty materials such as clinker. The Sicon belt also reduces the potential for dust emissions along the length of the conveyor as the belt forms a teardrop shape with belt edges brought together as shown in figure 3 below.

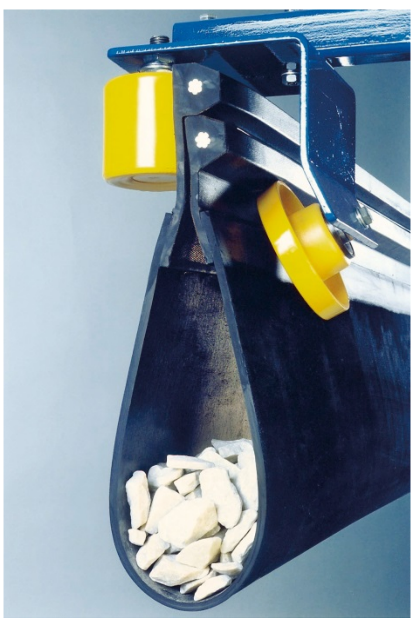

Figure 3 Sicon belt illustration

5.2.4. Once inside the mill 5 building the Sicon belt opens and becomes a troughed belt that discharges onto another belt conveyor which delivers the raw materials to the mill via a rotary valve.

5.2.5. The mill is a vertical roller mill (VRM) similar to that already used at Padeswood to grind raw meal and coal for kiln 4. The VRM has two pairs of rollers on hinged arms, which are pulled down using hydraulic pressure on to a rotating table driven using an electric motor. The clinker, gypsum, limestone and other raw materials used to make cement are crushed between the rollers the table. The mill fan draws air into the mill lifting the crushed material off the table into the mill body, the heavier and larger particles fall back onto the table for further grinding. Above the mill a dynamic classifier will be used to separate the particles that meet the size requirements of the finished cement, with the oversize material being returned to the mill for further grinding.

5.2.6. Once ground to the desired particle size, the resulting cement will then be collected in a bag filter and transported to cement storage and distribution facilities by pneumatic transport.

5.3. Process Description Cement transport

5.3.1. The pneumatic transport design selected for cement transport is a modern design.. The system will be designed to :

- Minimise solids velocities
- Operate at lower conveying pressure
- Reduce Wear
- minimise power requirements

5.3.2. In addition to the conveying benefits above the selected application has following benefits specific to the project as follows:

- Limited effect on site roads and potential internal road obstruction
- Reduced structures required compared to mechanical transport
- Reduce potential risks to existing structures and silo compared to mechanical transport.

5.3.3. A mechanical transport system (belt conveyors and bucket elevators) was considered for the transport of cement to the silos, however, this required more space to install and would mean modifying tanker access to silo 6 and reduced vehicle clearance in the silo 6 area. The heavier equipment would require the strengthening of some existing structures to support the increased weight. In addition to this the mechanical option carried a significantly higher capital cost due to the cost of the equipment itself and being heavier the infrastructure require to support it. The choice of pneumatic conveying does have slightly greater power consumption than mechanical transport but this increase is small compared with the overall benefits of the project. The same pneumatic system will transport cement from the mill bag filter to the new rail silos.

5.3.4. The pneumatic cement transport system will also feed Silos 1 & 2 which are used for storage of cement for packed products and are connected to the site's plastic and paper bag packing facilities.

5.4. Process Description Cement storage and loading

5.4.1. Most of the cement produced in mill 5 will be transported to Silo 6, an existing concrete silo with a capacity of 4,400 tonnes. As this silo is the main destination for Mill 5 product the mill has been positioned near to this silo to reduce transport distances and hence energy consumption in cement transport.

5.4.2. The Works has an operational rail connection and sidings, which are currently used for importing coal. The existing cement rail loading facility is obsolete and will be replaced as part of this project. The existing facility, principally silos 7, 8, 9, and 10 will be demolished and a new rail loading facility built including three new 1000 tonne cement silos. Each of these silos will be equipped with small (less than 10,000 Nm^3/h capacity) filters to control particulate emissions from transport and silo aeration air. These filters will be specified to emit less than 10 mg/Nm^3 as required by BAT conclusion 16. Each silo will be equipped with continuous level monitoring, emergency pressure relief valves and automated silo protection systems to prevent overfilling.

5.4.3. To optimise the site layout and accommodate trains, sections of the existing railway line will be realigned and extended. The new rail loading facility will accommodate maximum train length of 350 metres and will enable between 4,000 and 5,000 tonnes of cement to be transported from site by rail each week. The rail loading facility will have the ability to load up to a maximum of 1,700 tonnes per train and it is expected that 2-4 trains will be loaded per week, with each train taking up to 8 hours to load. The facility will be designed to load and weigh both 2 and 4 axle rail tanker, as well as road tankers. The loading heads on the rail silos will include bag filters specified to comply with the 10 mg/Nm^3 emission level specified in BAT conclusion 16.

5.4.4. All the milling systems and in particular the filters and dedusting equipment required for the operation of mill 5 and the associated silos will be covered by the planned maintenance system.

6. Noise and Vibration

6.1. The grinding of cement is inherently noisy. The operation of a vertical mill is quieter than a ball mill, thus with the installation of mill 5 the general noise level from the plant is expected to be lower.

6.2. <u>BAT Conclusion 2</u>

6.2.1. The BAT conclusion 2 states "In order to reduce/minimise noise emissions during the manufacturing processes for cement, lime and magnesium oxide, BAT is to use a combination of the following techniques". The table below summarises the techniques and which of these techniques can be implemented on mill 5 to control noise.

Reference	Description	Applied to CM5
a	Select an appropriate location for noisy operations	Yes
b	Enclose noisy operations/units	Yes
c	Use vibration insulation of operations/units	Yes
d	Use internal and external lining made of impact-absorbent material	N/A
e	Use soundproofed buildings to shelter any noisy operations involving material transformation equipment	No
f	Use noise protection walls and/or natural noise barriers	No
g	Use outlet silencers to exhaust stacks	Yes
h	Lag ducts and final blowers which are situated in soundproofed buildings	Yes
i	Close doors and windows of covered areas	Yes
j	Use sound insulation of machine buildings	Yes
k	Use sound insulation of wall breaks, e.g. by installation of a sluice at the entrance point of a belt conveyor	No
l	Install sound absorbers at air outlets, e.g. the clean gas outlet of dedusting units	No
m	Reduce flow rates in ducts	No
n	Use sound insulation of ducts	No
o	Apply the decoupled arrangement of noise sources and potentially resonant components, e.g. of compressors and ducts	Yes
p	Use silencers for filter fans	Yes
q	Use soundproofed modules for technical devices (e.g. compressors)	Yes
r	Use rubber shields for mills (avoiding the contact of metal against metal)	No
s	Construct buildings or growing trees and bushes between the protected area and the noisy activity	Yes

Table 3 Summary of noise control techniques in BAT conclusion

6.2.2. A noise impact assessment has been carried out by NWG. The report demonstrates there is small increase in noise levels at the closest receptors on Padeswood drive of less than 1dBA. This is a worst case assessment as it assumes the simultaneous operation mills 1, 2, 3 and 5 in addition to all the other site operations. The noise modelling results under these conditions are presented in table 4 below. Table 5 below shows the modelling results when mill 5 is the only operating cement mill which can be consider the normal operating conditions for the plant. Under these conditions there is a significant noise reduction at some receptors. In these tables the properties on Padeswood Drive are numbers 1 to 6 starting at the house nearest the works entrance and not by their postal addresses. A full copy of the noise consultant's report is provided in appendix 7.

Receptor ID	Location	Existing Background (Production + cement mills1,2,3,4 operational) (dBA)	Existing Background+ VRM (Production + cement mill 1,2,3 and VRM operational) (dBA)	Level difference (dBA)	X Coordinates (m)	Y Coordinates (m)
1	Spon Green	35.8	36.0	0.2	328545	363299
2	Ty Gwyn	46.6	46.5	-0.1	328319	362372
3C	Dyke Farm	46.1	46.0	-0.1	328489	361832
4	Toll Bar Cottage	40.9	40.5	-0.4	328563	361184
5	Penyffordd Play area	43.8	41.9	-1.9	329734	361442
6	Hawarden Road	34.4	34.8	0.4	330305	362434
7A	Sports Ground	45.9	46.3	0.4	329216	362582
B	Oak Tree Farm West	45.3	45.5	0.2	328629	362499
D	Oak Tree Farm East	43.1	43.5	0.4	329675	362352
E	Penyffordd Station	39.1	37.3	-1.8	329555	361097
	Padeswood Drive garden	45.4	45.7	0.3	329199	362593
	Padeswood Drive 1	45.7	45.8	0.1	329184	362638
	Padewsood Drive 2	45.2	45.5	0.3	329216	362648
	Padeswood Drive 3	44.0	44.4	0.4	329256	362661
	Padeswood Drive 4	44.6	45.0	0.4	329286	362673
	Padeswood Drive 5	43.6	44.5	0.9	329316	362681
	Padeswood Drive 6	43.6	44.0	0.4	329346	362691
	Oak Tree Farm East Facard	38.6	37.4	-1.2	329711	362293
	Ash Tree Farm Facard	39.0	39.4	0.4	329781	362664

Table 4 Predicted noise levels worst case example of all available mills running for each scenario

Receptor ID	Location	Existing Background (Production + cement mills1,2,3,4 operational) (dBA)	Existing background + VRM only all other mills off(dBA)	Level difference (dBA)	X Coordinates (m)	Y Coordinates (m)
1	Spon Green	35.8	35.9	0.1	328545	363299
2	Ty Gwyn	46.6	40.2	-6.4	328319	362372
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	Ash Tree Farm Facard	39.0	39.3	0.3	329781	362664

Table 5 Predicted noise levels existing operation and operation with mill 5 as the only cement mill

6.2.3. Given the small difference between the existing and future scenarios providing additional sound insulation on the mill 5 building had negligible benefit.

6.2.4. There are unlikely to be any vibration impacts at sensitive receptors, the vertical mill is smaller than the raw mill already in operation and similar vibration controls will be implemented. Vibration from the raw mill is noticeable on start up in the works office approximately 50m from the mill. It is not evident at greater distances. Given that cement mill 5 is smaller and significantly further away from neighbouring properties than 50 m it is very unlikely that there will be vibration impact.

7. Odour

7.1. There are no odours associated with the grinding of cement clinker.

8. CM5 Monitoring

8.1.1. Particulate emissions from cement mill 5 will be monitored continuously; however, due to the very low level of emissions it is not possible to carry out calibrations of these monitors to demonstrate compliance with the emission limit value. The difficulties associated with calibration on CEMS at low dust levels were covered extensively in the response to improvement condition IC3.

8.1.2. The continuous monitors will be used to monitor filter performance and initiate reactive maintenance. The continuous monitor will clearly show when filter performance is deteriorating as filter bags age or when there is a bag failure. Demonstration of compliance with the BAT AEL will be by annual extractive sampling in accordance with EN13284.

8.1.3. The low levels of CO, NOx and SO2 emissions in combination with the limited operating hours of the hot gas generator means that continuous monitoring of these emissions is unnecessary. Hanson Cement proposes to carry out spot sampling when the hot gas generator is operating in the first year of production to confirm this. For mass emission reporting proposes the SO2 emission can be calculated from the fuel consumption and sulfur content. The expected annual fuel consumption of the hot gas generator is less than 10% of the current gas oil consumption of works vehicles.

8.2. BAT Conclusion 5

8.2.1. The mill filter will be a bag filter designed to meet the BAT AEL of 10 mg/Nm3 dry and equipped with a continuous emission monitor.

9. CM5 Energy

9.1. Cement manufacture is an energy intensive process, around 90% of the energy consumption is fuel used to fire the kilns. There will be no changes to the functioning of the kiln as a result of this variation. The remaining 10% of energy consumption is electricity. Typically around 60% of the electricity consumption is used by the kiln with the remaining 40% consumed in the grinding of cement. The use of a vertical roller mill for cement grinding will significantly reduce the electrical energy consumption in the cement grinding process. The energy consumption of a ball mill is around 60 kwh/t for Cem 1 production. The operation of cement mill 5 is expected to reduce this to around 40 kwh/t for the same product.

9.2. The operation of a conventional ball mill for cement grinding converts much of the input energy to heat and noise. The heat produced by the grinding action in the mill is sufficient to dry the moisture present in the raw materials (gypsum and limestone, clinker the main raw material is dry). In addition to driving off any free moisture the water of crystallisation in the gypsum also needs to be removed for quality reasons. The heat generated in a vertical mill may not always be sufficient to increase the air temperature to remove this water from the raw materials. In these circumstances additional heat will be provided using a hot gas generator. The mill will be equipped with a burner to generate sufficient heat for this duty. The additional heating is likely to be required when ambient air temperatures are low, clinker temperature is low and when CEM II products containing more limestone are milled. Even in these circumstances it is possible that once the mill achieves the correct operating temperature that this will be self-sustaining and the hot gas generator will only be required during start up.

9.3. The hot gas generator will have a capacity of 3 KW (10.8MJ) - this will consume approximately 250 kg of gas oil per hour when in use. A portion of the exhaust gases after the bag filter will be recycled to the mill to minimise the fuel requirements from the hot gas generator i.e. instead of heating ambient air from 10 to 120°C the recycled gas will be heated from 60 to 120°C.

9.4. Hanson Cement has considered using waste heat from the clinker cooler as a potential source of drying air for the mill. However, the mill will be required to operate when the kiln line is stopped for maintenance and therefore the hot gas generator(HGG) will be required as part of the design. The use of excess hot air from the cooler will require approximately 500m of ductwork with supports and fans which has a higher capital cost than the HGG. The power consumption of a fan to transport hot air over this distance is greater than that of the recirculating fan, thus the only potential energy saving is in the fuel used in the HGG.

9.5. Castle Cement Limited is no longer a participant in the climate change levy agreements. This is because the Government has exempted energy intensive industries in the mineral and metallurgical sectors from climate change levy payments under the taxation of energy products directive. As the company is no longer required to make levy payments it is not possible to remain in the cement sector climate change levy agreement. Hanson UK operations are covered by the Energy Efficiency Directive and energy savings opportunity scheme. The requirements ESOS are met through certification to ISO50001. Site energy usage is reported monthly at site and Hanson Cement executive level, energy saving opportunities are recorded in a database and progressed by the site energy team.

9.6. The benefits of the mill 5 project are summarised in the table below based on a nominal cement production of 500,000 tonnes. The reduction in direct and indirect CO_2 emissions as a result of the mill 5 installation is 3970 tonnes per year at this production level. With mill 5 operated at full capacity this energy saving is increased as the clinker currently exported from the site is ground using ball mills of similar design to those being replaced at Padeswood. In addition to this there is the avoided emission of replacing road transport with rail.

9.7. The conversion from delivered grid electricity to primary energy is multiplying by 2.6 as set out in climate change agreements. This probably over estimates the impact as the CO_2/kwh of grid electricity has fallen from 535 g/kwh in 2001 to 412 g/kwh in 2016.

Energy	Current operation		CM5 operation	
	MWh	%	MWh	%
Grid Electricity MWh primary	78,000	100%	52,000	99%
Gas oil/PFO /Kerosene MWh			563	1%
Total MWh Primary	78,000		52,563	
SEC kWh primary/tonne	156		105	
Direct and Indirect CO2	12,360		8,390	

Table 6 Summary of mill 5 energy consumption

10. CM5 Raw Materials

10.1. The principal raw material for cement produced using cement mill 5 will be clinker produced at Padeswood and if necessary clinker imported to the site from other cement plants. The mill will be capable of producing a range of cements which will have varying quantities of gypsum both natural and waste derived, limestone, Ground Granulated Blast Furnace Slag(GGBS) and Pulverised Fuel ash (PFA).

10.2. One of the key drivers for the cement industry to reduce carbon dioxide emissions is clinker substitution; each tonne of clinker replaced in finished cement reduces CO_2 emissions by between 750 and 850 kg depending on the material used. The type and level of replacement is dependent upon the cement specification and customer requirements. In the UK concrete industry it is common to replace the cement with additions at the concrete production plant therefore most of the cement produced for the bulk ready mix concrete market is CEM 1. Cement mill 5 will produce both CEM1 and

CEM2 cements, other grades of cement could be produced depending upon market demand.

10.3. The table below summarises the main raw material usage at Padeswood before and after the installation of cement mill 5 for the same clinker production.

Raw material	Current operation kt	With Cement Mill 5 kt
Limestone for clinker production	1,160	1,160
Sand	51	51
Shale/PFA	217	217
Coal	67	67
Waste derived fuels	48	48
Gypsum	33	46
Limestone for cement production	35	38
Total	1,611	1,627

Table 7 Summary of Raw material usage

10.4. The raw material consumption at Padeswood increases as result of more clinker being converted into cement on site rather than being sent to other Hanson Cement plants for grinding i.e. the overall Hanson UK raw material consumption is unchanged. It should be noted that the additional cement production is expected to be distributed from the site by rail, replacing road transport of clinker thus the overall environmental impact of the company is reduced. All the raw materials are delivered to Padeswood works by road with the exception of coal which is mainly delivered by rail.

10.5. The addition of mill 5 will make a small change to the works water consumption as the vertical mill does not normally require the use of internal cooling water that is consumed in a ball mill. It is sometimes necessary to use water to control the bed stability of material in the mill to ensure consistent mill grinding performance. A ball mill typically uses 60 litres of cooling water per tonne of product thus the benefit of installing mill 5 will a reduction in water consumption of around 25000 m^3 per year. The water consumed by mill 5 will be from the works surface water system and if necessary the works Kinnerton borehole supply.

10.6. There are over 40 different types of cement permitted in the EN197 standard. There is the scope to use other raw materials such as granulated blast furnace slag (GBFS) as a raw material in mill 5. The crane store and proposed feed system can handle other raw materials, for example using GBFS in the limestone hopper would allow the production of a wider range of CEM2 and CEM3 cements.

11. CM5 Waste

11.1. Under normal operation any process waste such as spillages of cement, clinker or other raw materials will be collected and returned to the process for grinding into cement. If this is not possible for quality control reasons then these materials will be processed through the kiln system to produce clinker.

11.2. The waste arising from maintenance work will be recovered by the same routes as currently in place on the site summarised in the table below. The quantity of waste produced from maintenance activities is not expected to change as a result of cement mill 5 installation.

Waste description	EWC code	Recovery/Disposal
Used lubricants	150110*	Recovery
Oily Rags	150202*	Recovery
Oil Filters	160107*	Recovery
Metal wear parts (Iron & Steel)	170405	Recovery
Waste oils	130205*	Recovery
Waste cement (inorganic wastes containing dangerous substances)	160303*	Recovery
Metal wear parts (Mixed metal)	170407	Recovery

Table 8 Summary of waste types expected to arise from cement mill 5 operation

12. CM5 Co-incineration

12.1. Kiln 4 at Padeswood is permitted to use waste as fuel in the co-incineration requirements of Chapter of the industrial emissions directive. Full details of the how the kiln complies with the technical and operational requirements of IED chapter IV were provided in the original PPC permit application.

12.2. This variation application does not require any changes to the operation of the kiln line or the permit conditions relating to the use of waste as a fuel. Appendix 6 of the C3 application form has been completed where necessary to maintain the same conditions that apply in the current permit.