JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
Version 01 - in effect as of: 15 June 2006

CONTENTS

Annexes

Please note that Annex 6 and Annex 7 have not been included in the PDD due to the large size of both documents. Both documents have been submitted to the Validator during the determination process.

SECTION A. General description of the project

A.1. Title of the project:

"Switch from wet-to-dry process at Podilsky Cement, Ukraine"
PDD Version 2.0, dated 29 August 2006

A.2. Description of the project:

Cement production is a highly energy intensive process that generates significant emissions of greenhouse gases, in particular CO_2. There are two main sources of CO_2 emissions in the cement production process. The first source is fossil fuel combustion and the second source is the chemical decomposition of the limestone into calcium oxide and carbon dioxide. The project aims to significantly decrease the emissions of the first source (fossil fuel combustion) at Podilsky Cement factory in Ukraine.

The Podilsky Cement factory was constructed in the 1970s and was originally equipped with six kilns producing cement using a wet production process. Currently four out of six kilns are in operation, a fifth kiln is moth-balled and the sixth kiln is decommissioned. The project will decrease the emissions of fossil fuel combustion by changing the technology of cement production from a wet production process to a dry production process.

Wet cement production technology is the conventional technology of cement production in Ukraine with a very limited number of dry and semi-dry technology examples[1]. During raw material preparation stage limestone, clay and additives are crushed and mixed in the raw mill. In the case of wet cement technology water is added to the raw mill together with the raw materials in order to produce slurry. The slurry is further homogenized and fed to the rotary kiln. At the point of the kiln inlet, at the drying zone, water is evaporated from the slurry, and raw materials are moved further into the kiln to be calcined and burnt into clinker. Evaporation of the wet slurry consumes significant amounts of energy. At present the average energy consumption at Podilsky Cement over the years 2003, 2004, and 2005 is 6,771 MJ per tonne of clinker produced (1618 kcal/kg).

In case of conventional *dry cement production* technology, the raw materials required are of low moisture content. Water is not added in the preparation of the mixture of raw materials (being called the raw meal in case of dry production scheme). Therefore water evaporation from the raw meal is not required. This significantly reduces the level of energy consumption of a dry cement kiln compared to a wet one, and therefore reduces the CO_2 emissions from fuel combustion. The expected energy consumption of the dry cement production system at Podilsky Cement will be approximately 3,180 MJ per tonne of clinker produced (760 kcal/kg). This constitutes a reduction of 53% in energy consumption.

[1] Adaptation of IPCC Guidelines and Software to Ukraine's Cement Sector, Kyiv 2004

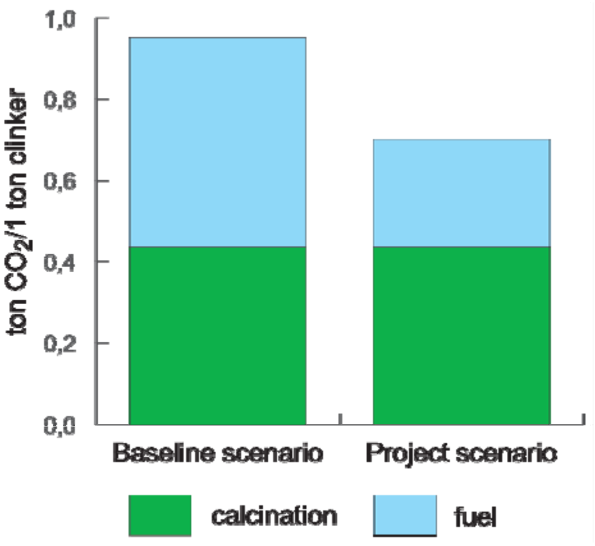

Figure 1: Specific CO_2 emission from calcination and fuel combustion

The proposed JI investment would include the following activities:
- Preparation of the site, including removal of obsolete installations;
- Installation of equipment for milling and homogenisation of the raw material;
- Installation of a precalciner and preheater tower;
- A new kiln for dry cement production;
- Mothballing of the wet kilns[2].

The 140 million Euro project, which constitutes the largest single investment in the Ukrainian cement industry since independence in 1991, has the following environmental benefits:
- Fighting climate change by reducing the emissions of GHG gasses;
- Reducing the environmental impact of Podilsky Cement by reducing the emissions of dust;
- Implementing Best Available Techniques standards for the emissions of non-GHG gases;

The project has the following social and economic benefits:
- Reinforcing the competitive position of one of the largest employers in the region;
- Securing the future for the employees of Podilsky Cement and it's suppliers and contractors;
- Additional employment of 300 construction workers (average) for the 24 month construction period;
- Transfer of modern cement making technology to Ukraine.

[2] The existing wet kilns will be available for restart in the event of a serious operational problem or disaster with the new kiln. Such contingency is required for at least 5 years while experience with the new technology is developed.

A.3. Project participants:

Party involved	Legal entity project participant (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host party)	JSC Podilsky Cement	No
Ireland	CRH Finance Limited	No

Table 1: Project participants

A.4. Technical description of the project:

A.4.1. Location of the project:

The project is located in Kamyanets Podilsky, Khmelnitsky region (oblast) in the Western part of Ukraine. The project is located 102 kilometres from Khmelnitsky, the capital of the region, and relatively close to borders with Romania and Moldova.

Figure 2: Ukraine and neighbouring countries

A.4.1.1. Host Party(ies):

Ukraine

A.4.1.2. Region/State/Province etc.:

Khmelnitsky region (oblast)

A.4.1.3. City/Town/Community etc.:

City of Kamyanets Podilsky

A.4.1.4. Detail of physical location, including information allowing the unique identification of the project (maximum one page):

Kamyanets Podilsky is situated 102 kilometres from Khmelnitsky, the capital of the region (oblast) in the Western part of Ukraine. The city of Kamyanets Podilsky is one of the main tourist attractions of Western Ukraine with numerous monuments and pieces of architecture preserved from the middle ages. The whole city is a protected area, and industrial activity within the boundaries of the historical part of the city is prohibited. Podilsky Cement is located seven kilometres away from the city. The plant is the biggest employer at the city of Kamyanets Podilsky and one of the biggest employers in Khmelnitsky oblast.

Figure 3: The city of Kamyanets Podilsky and Podilsky Cement site[3]

[3] Google Earth

A.4.2. Technology(ies) to be employed, or measures, operations or actions to be implemented by the project:

General description of cement production
The cement production cycle can be divided into four steps:

1. Raw materials extraction
The main chemical compounds necessary for cement production are contained in limestone ($CaCO_3$) and clay or loam (SiO_2, Fe_2O_3 and Al_2O_3). Limestone and clay (or loam) are extracted from natural deposits, crushed and transported to the cement production site.

2. Processing of raw materials
Crushed limestone and clay are mixed in a proportion of approximately 4:1. In the case of wet production technology water is added to form slurry, which is later evaporated in the drying section of the rotary kiln. In the dry process raw materials are mixed, milled and homogenized without adding water. The waste heat from the dry kiln can be used to dry the raw materials on the preparation stage.

3. Clinker burning
The raw meal is passed to a rotary kiln. Under the influence of high temperatures, limestone (calcium carbonate) is calcined into lime (calcium oxide) and carbon dioxide:

$$CaCO_3 + heat \Rightarrow CaO + CO_2$$

This chemical reaction is one of the two main sources of carbon dioxide during cement production. The other main source of CO_2 is fuel burning in order to heat the kiln. After the calcination, the calcium oxide reacts with the other chemical compounds present at the temperatures between 1400 – 1450^oC. This reaction is called sintering. The final product of these reactions is called clinker. Clinker that comes out of the kiln is cooled and heat returned to the process by clinker coolers.

4. Making cement from clinker
The last stage of cement production is fine crushing of clinker in cement mills to the state of powder. Mineral components (e.g. slag, fly ash, or gypsum) are added to the clinker and milled in order to produce different types of cement.

Current situation at Podilsky Cement
The current situation at Podilsky Cement is presented in a figure below. Currently Podilsky Cement operates four wet rotary kilns with a length of 185 meters and a diameter of 5 meters. One wet rotary kiln is mothballed.

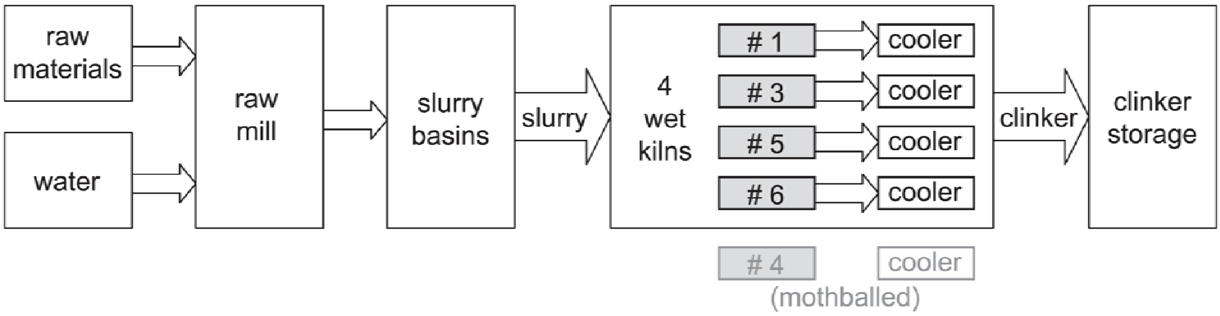

Figure 4: Existing wet cement production process at Podilsky Cement.

Raw materials are individually crushed. They are mixed and milled to a slurry with the addition of water in the raw mills. After homogenisation in slurry basins, the kiln feed slurry is fed into rotary wet kilns. The first process in the kiln is the evaporation of water. Thereafter, with the mineralogical/chemical reactions of calcination and sintering, clinker is formed. The clinker is then passed to the cooler, and further to cement grinding.

The daily production capacity of the existing kilns is 1632 tonne of cement per day for one kiln. Wet rotary kilns can be operated 325 days per year. Giving 2% time for emergency stops, the total production capacity of the existing installation is 3.0 million tonne of cement per year (see annex 2). The production levels during 2010-2012 are projected at the level of 2.5 million tonne of cement per year. Thus, the cement production volumes are not expected to exceed the capacity of the existing wet kilns.

Situation after project implementation
In the case of proposed JI project the existing four wet kilns will be replaced with one modern dry kiln system. The raw material preparation in the dry cement production process will also be changed compared to the case of wet technology. The new production scheme in case of the proposed JI project is presented in the figure below. The existing four wet kilns will be replaced by a four-stage calciner kiln system with a modern efficient grate cooler.

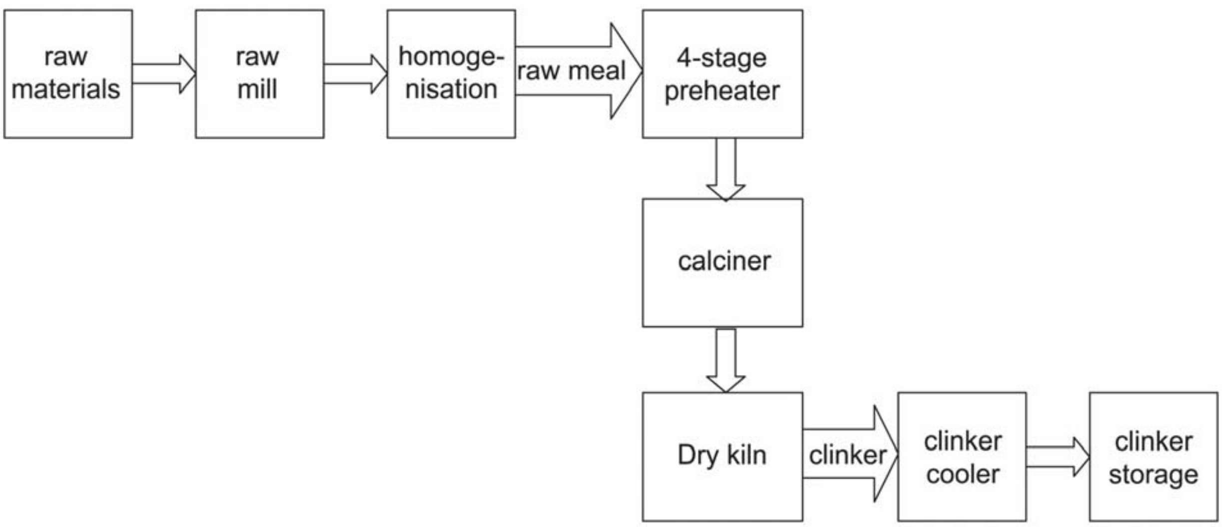

Figure 5: Dry cement production scheme in the project scenario.

The raw materials are milled without water to form raw meal. The raw meal is homogenised to give chemical consistency, and then fed to the precalciner system. Since there is no need to evaporate water from the homogenised raw materials mix, the fuel consumption will be significantly reduced. The precalciner system will further reduce fuel consumption. The waste heat from the dry kiln is supplied to the raw mill to dry the raw materials. The raw meal, which is fed to the precalciner system, is heated to a temperature of around 800^{o}C by the exhaust heat from the kiln. The temperature in the precalciner is controlled at the level of about 950^{o}C to ensure that the calcination reaction takes place. As a result, the raw meal that reaches the kiln is virtually 100% calcined. After sintering process, which takes place in the kiln, the clinker formed is fed to the cooler and further to the clinker storage.

To allow commissioning of the raw mill system, a heat generator will be installed to allow the raw mill produce the first rawmeal before the kiln start. Conventionally, this heat generator is not required thereafter and has not been included in the project monitoring plan. In the event of its operation being required thereafter, it will be added to the plan.

The technology change, both in the raw material preparation scheme and the use of precalciner system, would allow a reduction in energy consumption of the dry kiln to 3,180 MJ per tonne of clinker. The average fuel consumption of the existing wet rotary kilns is about 6,771 MJ per tonne of clinker. This considerable decrease in fuel consumption by the kiln system leads to a significant reduction of CO_2 emissions.

The production capacity of the new kiln will be approximately 7,000 tonne of clinker per day. It is expected that the dry kiln will work 330 days a year with a 2% allowance for emergency stops. Therefore, the yearly capacity of the new installation will be approximately 2.6 million tonne of cement.

The wet kilns will be moth-balled. In the event of an emergency or disaster with the new dry line, the old wet kilns will be restarted. The wet kilns will be kept in reserve for a period of 5 years, which is felt to be the appropriate time period to fully test the new dry line. It is planned to use coal as the primary fuel for the foreseeable future, however should security of supply of coal become an issue, either natural gas other suitable fuels will be used.

Maintenance of new installation
Maintenance planning is carried out on the basis of annual schedules of equipment maintenance that are made on the basis of national maintenance standards. Routine maintenance work is done by the qualified personnel of Podilsky Cement. In the case maintenance procedures cannot be done internally, an external company is contracted to do the maintenance work.

The plant provides the external contractor with design documentation, estimates and technical documentation, necessary materials and spare parts. The plant is obliged to provide a contractor with compressed air from plant network, oxygen, water, electric power, hoisting machines during preparatory and maintenance work. In case the contractor is using his own energy recourses the plant pays for them according to contractor estimates and prices.

After an object has been passed for and relevant report on that has been signed contracting company is totally responsible for its employees’ safety, for proper and safe operation of all power circuits and communications. The contractor is obliged to carry out the maintenance works closely according to design estimates and technical documentation, provided by the plant (maintenance schedule, financial estimates, and drawings). The contracting organization must remove all defects at its own expense in case if maintenance was not fulfilled in compliance with a standard.

Although the maintenance programme for this project has not yet been finalised at this stage, it will be of a similar structure to that of the coal mill project 2006 at Podilsky Cement.

Training for the project
The project involves new technology to Ukraine and therefore an extensive training programme will be put in place. CRH has vast experience in modern conventional kilns and will provide training and assistance to Podilsky Cement during the design, construction and commissioning phases of the project. The chosen supplier of the equipment will also be contracted by CRH to provide extensive training and on-site assistance. Although the training programme for this project has not yet been finalised at this stage, it will be of a similar structure to that of the coal mill project 2006 at Podilsky Cement, which has been made available to the Validator.

Risks of the project
The risks of the project are summarised in the following table:

Risks	**Mitigation**
1. Financial risk	
The proposed JI project requires large-scale financing for the long term. The national financial market would not be able to provide such kind of financing because of scarce resources. Besides, Ukrainian financial market is oriented for a short-term (up to three years) project financing. On the international market large-scale financing for a project in Ukraine is limited and expensive due to the country-specific risks.	CRH is willing to provide long-term financing for the project in case investment criteria are met.
2. Technological risk	
Wet cement production technology is the common practice in Ukraine as well as in the neighbouring countries. There is lack of knowledge and experience in switching from wet to dry technology in Ukraine.	CRH is operating dry cement kilns, and has practical experience in switching from wet to dry technology. CRH will assist Podilsky Cement in overcoming the technological risk.
3. Market risk	
Podilsky Cement is producing cement for the national market in Ukraine. Cement production levels are directly related with the market demand. Economic recession might lead to the less production levels than expected.	Conservative market forecasts were taken to estimate production levels during the crediting period.
4. JI approval risk	
There is a risk of no approval of the (JI) project by Ukrainian government as the regular approval procedure is not yet in operation.	Podilsky Cement has held consultations with the authorities on the regional level and received formal support for the project (see Annex 4). The project (PIN) was presented to the responsible Ministry in an early stage.

Table 2: Summary of risks of project

Apart of the significant reduction of emission of GHG-gasses, the project will also decrease the emissions of dust. The effect of the project on the emissions is described in section F.

A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reductions would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

Although switching from wet to dry has some significant advantages, the project faces two important barriers:

Financial and economic barrier
The cement industry is a capital intensive industry and the proposed project requires a significant amount of financing. For Podilsky Cement it would be difficult to obtain financing of 140 million Euro on the domestic financial market, since the sources for project financing are very limited, and the interest rates are high. On the international market obtaining financing for this project would also be difficult due to the low credit rating of Ukraine and the high perceived risks of the country's market.

The mother company CRH has access to the required financial resources to finance the project. However, the investment does not meet the CRH company-wide applied criteria in order to justify the project. In particular, the level of the internal return rate (IRR) does not meet the investment requirements of CRH.

Lack of experience and technology in Ukraine
Wet production of cement is the common technology in Ukraine and other countries of the former Soviet Union. In Ukraine, there is little experience in applying dry production technology.

CRH has the necessary experience in constructing and operating dry process plants. Additional revenue from the transfer of ERUs is the key factor to bring in foreign experience and technology and to alleviate this barrier.

Given both barriers and the impact of Joint Implementation, the proposed JI project is additional to what would otherwise occur. A more detailed description on baseline setting and additionality can be found in section B.

A.4.3.1. Estimated amount of emission reductions over the crediting period:

Length of the period within which emission reduction units are to be earned	Years 4
Length of the crediting period	4
Year	Estimate of annual emission reductions in tonnes of CO_2 equ.
Year 2008	0
Year 2009	733,642
Year 2010	763,732
Year 2011	763,254
Year 2012	762,775
Total estimated emission reductions over the period within which emission reduction units are to be earned (tonnes of CO_2 equ.)	3,023,403
Total estimated emission reductions over the crediting period (tonnes of CO_2 equ.)	3,023,403
Annual average of estimated emission reductions over the crediting period/period within which emission reduction units are to be earned (tonnes of CO_2 equ.)	755,851

Table 3: Estimated amount of emission reductions over the crediting period

A.5. Project approval by the Parties involved:

The Project Idea Note had been submitted for review of the Ministry of Environment of Ukraine.

After the project has gone through the determination process, the PDD and the Determination Protocol will be presented to the Ministry of Environment of Ukraine to obtain a Letter of Approval.

SECTION B. Baseline

B.1. Description and justification of the baseline chosen:

Introduction
Any baseline for a JI project should be established in accordance with Appendix B of the Marrakesh Accords[4] and in accordance with guidance of the Joint Implementation Supervisory Committee (JISC). At the moment of preparing this PDD, guidance was being drafted by the JISC.

In accordance with decision 10/CMP.1, approved CDM methodologies can be used to develop PDDs of JI projects. For the cement industry three approved methodologies exist (ACM0003, ACM0005 and AM0024). None of these methodologies can be applied directly to the project, but these methodologies have been carefully studied to identify the main principles underlying the approach to baseline setting, additionality and monitoring. While identifying the baseline and project emissions, the general principles of Annex B of 16/CP.7 (in particular: project-specific approach, taking conservative assumption, and taking into account relevant policies) have been adhered to.

Furthermore, the “CO2 Emissions Monitoring and Reporting Protocol for the Cement Industry” of the World Business Council for Sustainable Development (WBCSD)[5], Working Group Cement has been applied to calculate the emissions of the baseline and project scenario.

In proving the additionality of the project the most recent “Tool for the demonstration and assessment of additionality (version 02)” has been applied. Please refer to section B.2.

Approach to select the baseline scenario
The baseline is the scenario that reasonably represents the anthropogenic emission by source of greenhouse gases that would in absence of the proposed project[6]. In many CDM methodologies the approach to establish the baseline is firstly to identify several baseline alternatives. The proposed project, not registered as a JI project, should be included as an alternative as well. These alternatives should be assessed whether or not these alternatives are credible and plausible. Where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario. There should be consistency between baseline scenario determination and additionality determination.

The approach described above has been used to identify the baseline scenario for Podilsky Cement.

Identification of alternatives
Podilsky Cement is producing cement for the Ukrainian market. Within this market Podilsky Cement should work within the following constraints:

- The cement market is a competitive market;
- The factory should meet the quality requirements of its clients;
- The factory should be able to meet the growing demand for cement on the Ukrainian market;
- And the factory should be profitable at the same time.

---

[4] FCCC/CP/2001/13/Add.2 16/CP.7.

[5] www.wbcsd.org

[6] FCCC/CP/2001/13/Add.2 16/CP.7. Appendix B

Given these constraints Podilsky Cement identified the following five alternatives to work within the constraints detailed above.

1) Production of cement using a wet process with natural gas as fuel

Podilsky Cement started producing cement in the 1970s by applying a wet process. The wet process was the predominant technology that was implemented in the Soviet Union. The main reason to use a wet process was the ease in raw material handling and to control the quality of the cement. Energy efficiency was not considered to be high priority at that time. Natural gas was chosen as the fuel for the kiln. In the (former) Soviet Union natural gas has been subsidised, allowing cement factories to continue using natural gas whereas in Western Europe coal has been the main source of fuel[7] due to the higher cost of natural gas. This alternative would constitute a continuation of the situation that existed at Podilsky Cement before autumn 2006.

2) Production of cement using a wet process with coal as fuel

Natural gas in Ukraine is more expensive when compared to coal. The price of natural gas has risen sharply in the past two years and it is expected that over the years the price of natural gas will approach a level similar to those in Western and Central Europe. The Board of CRH decided in February 2005 to invest in a coal mill to allow Podilsky Cement use coal as kiln fuel. Using coal will reduce the energy costs of the factory and secure the supply of fuel for the future. This alternative will become the reality with the commissioning of the coal mill in autumn 2006.

3) Production of cement using a dry process with natural gas as a fuel

In this alternative Podilsky Cement will switch its process from wet-to-dry. A detailed description of the investment activities required to switch in technology has been described in section A.4.2. The required investment would be approximately 140 million Euro. The Board of CRH has not decided on this investment. In this alternative the new dry kiln will be fuelled with natural gas. This alternative would become possible with the commissioning of the dry kiln expected in early 2009.

4) Production of cement using a dry process with coal as a fuel

This alternative represents the proposed JI project and assumes that coal will be used as a fuel. This alternative does not take any JI incentive (transferring ERUs) into account. The required investment would be approximately 140 million Euro and the Board of CRH has not decided on this investment. This alternative would become possible with the commissioning of the dry kiln expected in early 2009.

5) Construction of a new cement plant

A fifth alternative would entail the construction of a complete new cement production facility. As the construction of a new plant would take several years, construction should take place at a new production site. For this site the necessary permits would have to be obtained and the new factory should be connected to the required infrastructure. The existing cement plant would be decommissioned. The new facility would apply the best available technologies in terms of fossil fuel consumption, electricity consumption, dust emissions and other impact on the local environment. This facility would most likely be based on a dry process with coal as a fuel. The investment requirement for this option ranges from 200 to 300 million Euro.

[7] "Best Available Techniques" for the cement industry, CEMBUREAU, 1999

Assessment of the alternative scenarios
The following parameters were used to assess whether the different scenarios for the JI project are credible and plausible.

Item	Unit	Value
Cost price of natural gas (June 2006)	EUR/GJ	2.9
Cost price of coal (June 2006)	EUR/GJ	1.8
Energy consumption wet process	MJ/t clinker	6 771
Energy consumption dry process	MJ/t clinker	3 180
Production capacity wet process	t cement/year	3.0 million
Production capacity dry process	t clinker/year	2.6 million
Expected market demand 2012	t clinker/year	2.5 million

Table 4 : Key information used to asses the different baseline alternatives

Assessment of alternative 1 & 3: Production of cement using natural gas as a fuel
Podilsky Cement has been confronted with an increasing cost price of natural gas. Currently (June 2006) the cost price of natural gas is 60% higher than the cost price of coal. As the fuel cost is an important factor in the production cost of cement, Podilsky Cement decided in 2005 to install a coal mill to enable the factory to switch to coal. The coal mill will be commissioned in autumn 2006.

The trend of the price of natural gas is upwards and will, in time, approach a level similar to those of Western and Central Europe. It is therefore unrealistic to assume that Podilsky Cement will use natural gas as a kiln fuel after the commissioning of the coal mill (for reference: the conventional fuel in cement factories in Western Europe, USA, China and India is coal). Moreover, security of natural gas supply became an issue for Podilsky Cement, after a brief interruption of gas supplies to Ukraine in January 2006. These two factors make alternative 1 and 3 neither a credible nor plausible alternative and have been excluded from further consideration.

Assessment of alternative 2: Production of cement using a wet process with coal as fuel
The wet process is the predominant cement making technology in Ukraine. Podilsky Cement can continue to use the wet process, while keeping its’ market share as a significant change to dry process production by the Ukrainian industry is unlikely. The key issue is the high moisture content of raw materials available to Ukrainian producers. The chalks, clays, marls and limestones used contain more moisture than is suitable for conventional dry process factories. Conventionally, a mean moisture content of 12 to 14% is the limit for dry process. In Ukraine, limestones, chalks and clays can contain up to 25% moisture. Major competitors operate plants with such raw materials.

Podilsky Cement expects their market share to be 2.5 million tonne of cement in 2010. Alternative 2 will be able to produce this amount without making any significant investments, but with the rehabilitation of kiln 4.

Podilsky Cement has received the permit to construct the coal mill and the mill is almost complete. Podilsky Cement expects to receive an operational permit to start fuelling coal in autumn 2006 upon completion of the construction works.

Hence alternative 2 is a credible and a plausible alternative.

Assessment of alternative 4: Production of cement using a dry process with coal as fuel
Using a dry process has some considerable advantages. The main advantage is that it consumes much less fuel. It is estimated that a dry process would lead to a reduction of the energy consumption of more than 50%. Reduction of energy consumption is also in line with the policy of the Ukrainian government. In March 2006 the government of Ukraine adopted the "Energy Strategy of Ukraine till 2030[8]". Energy efficiency is one of the corner stones of this strategy.

The new dry kiln system will be able to meet the expected market demand and will be in line with Ukrainian rules and regulations. However changing from wet-to-dry requires a significant investment plus the application of new technology in Ukraine.

Conclusion
Only alternative 2 (wet production) and alternative 4 (dry production) are realistic and credible alternatives. However, alternative 4 is economically not attractive and faces barriers. This is proven in the next section, using the latest versions of the "Tool for the demonstration and assessment of additionality".

Alternative 2 is the only remaining realistic and credible alternative and is identified as the baseline scenario.

The baseline emissions of alternative 2 are elaborated in section D.

B.2. Description of how the anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the JI project:

The "Tool for demonstration and assessment of additionality (version 02)" has been applied to show that the anthropogenic emissions of the greenhouse gases are reduced below those that would have occurred in the absence of the JI project.

Step 0. Preliminary screening
a) The project activity has not been started yet and the JI activity will start after 1st January 2000. The construction of the project is expected to start, pending JI and board approval, in 2007 with the new kiln to be commissioned beginning of 2009.

b) The JI project is currently being considered by Podilsky Cement. The project has not been approved by the board. Due to the expected low economic performance of the investment additional revenue from JI has been taken into account from the very beginning of the project development activities. The following documents are available providing evidence:

1. On the 23rd of November 2004 a presentation concerning Kyoto and JI was given to the management of Podilsky Cement;
2. On the 11th of January 2005 a report was prepared for Podilsky Cement to make a preliminary assessment of the JI eligibility of the project and to estimate of the emission reduction potential;
3. In December 2005 a Project Idea Note was prepared and presented to the Ukrainian Ministry of Environment.

[8] http://mpe.energy.gov.ua/minenergo/control/uk/archive/docview?typeId=10000117912

Step 1. Identification of alternatives to the project activity

1) Production of cement using a wet process with natural gas as fuel

Podilsky Cement started producing cement in the 1970s by applying a wet process. The wet process was the predominant technology that was implemented in the Soviet Union. The main reason to use a wet process was the ease in raw material handling and to control the quality of the cement. Energy efficiency was not considered to be high priority at that time. Natural gas was chosen as the fuel for the kiln. In the (former) Soviet Union natural gas has been subsidised, allowing cement factories to continue using natural gas whereas in Western Europe coal has been the main source of fuel[9] due to the higher cost of natural gas. This alternative would constitute a continuation of the situation that existed at Podilsky Cement before autumn 2006.

2) Production of cement using a wet process with coal as fuel

Natural gas in Ukraine is more expensive when compared to coal. The price of natural gas has risen sharply in the past two years and it is expected that over the years the price of natural gas will approach a level similar to those in Western and Central Europe. The Board of CRH decided in February 2005 to invest in a coal mill to allow Podilsky Cement use coal as kiln fuel. Using coal will reduce the energy costs of the factory and secure the supply of fuel for the future. This alternative will become the reality with the commissioning of the coal mill in autumn 2006.

3) Production of cement using a dry process with natural gas as a fuel

In this alternative Podilsky Cement will switch its process from wet-to-dry. A detailed description of the investment activities required to switch in technology has been described in section A.4.2. The required investment would be approximately 140 million Euro. The Board of CRH has not decided on this investment. In this alternative the new dry kiln will be fuelled with natural gas. This alternative would become possible with the commissioning of the dry kiln expected in early 2009.

4) Production of cement using a dry process with coal as a fuel

This alternative represents the proposed JI project and assumes that coal will be used as a fuel. This alternative does not take any JI incentive (transferring ERUs) into account. The required investment would be approximately 140 million Euro and the Board of CRH has not decided on this investment. This alternative would become possible with the commissioning of the dry kiln expected in early 2009.

5) Construction of a new cement plant

A fifth alternative would entail the construction of a complete new cement production facility. As the construction of a new plant would take several years, construction should take place at a new production site. For this site the necessary permits would have to be obtained and the new factory should be connected to the required infrastructure. The existing cement plant would be decommissioned. The new facility would apply the best available technologies in terms of fossil fuel consumption, electricity consumption, dust emissions and other impact on the local environment. This facility would most likely be based on a dry process with coal as a fuel. The investment requirement for this option ranges from 200 to 300 million Euro.

---

[9] "Best Available Techniques" for the cement industry, CEMBUREAU, 1999

Sub-step 1b. Enforcement of applicable laws and regulations
All the proposed alternatives to the proposed JI activity are within the applicable laws and regulations of Ukraine. The existing legislation allows a continuation of a wet process and it is not expected that any national regulation, which would require cement plants to switch from wet to dry production process, would appear in future.

The existing Ukrainian legislation encourages more efficient energy use and energy saving[10]. Decreasing the energy and fuel intensity of all economy sectors is stated as one of the main priorities of the newly approved Energy Strategy of Ukraine until 2030[11]. Both of the mentioned legislative documents recommend reducing the intensity of energy and fuel use. The proposed JI project at Podilsky Cement will significantly reduce fuel consumption, and therefore, it is in line with the relevant national legislation and the country's priorities mentioned above. However, energy saving and decrease of fuel consumption is not *required* by any existing national legislation.

Step 2. Investment analysis

Sub-step 2a. Determination of analysis method

The proposed JI activity will contribute to a reduction of energy consumption. A simple cost analysis (Option I) is not applicable.

The decision to make an investment at Podilsky Cement is made by its shareholder CRH. Within CRH, investment decisions are based on two main indicators:

- The plant should fit into the company’s corporate strategy vision;
- Each investment should meet the economic requirements which are applicable to all investments.

CRH is only considering one alternative at Podilsky Cement (see Section B.1.) and hence does not apply an investment comparison analysis for the plant. A benchmark analysis based on the company internal guidelines is the most suitable way to describe the decision making process for this project and hence to assess the additionality of the project.

Sub-step 2b. Application of benchmark analysis
All capital expenditure projects of the CRH Group are evaluated in accordance with similar guidelines. The financial evaluation of the projects is always based on their incremental effects i.e. receipts and expenditures solely attributable to the commencement of the project.

Depending on the nature of the investment, the capital expenditure projects are classified into different categories and projects in each category require different evaluation measures. The most commonly used financial indicators are Real DCF ROI (also known as IRR), RONA (Return on Net Assets), Payback Period and NPV (Net Present Value). The same basic requirements and evaluation measures apply for all investment projects within the Group, and hurdle rates for each investment category are set by the Group Finance.

The project under consideration falls under the ‘Profit Improvement’ category, and being sufficiently large in value terms it will require a formal approval of the CRH board, and will be evaluated using Real DCF ROI as the primary financial indicator. Generally, all capital expenditure projects classified as Profit Improvement projects and in excess of 1 million Euro should meet Real DCF ROI requirements.

---

[10] The Law of Ukraine “On energy saving”.

[11] Ministry of Energy of Ukraine. *The Energy Strategy of Ukraine until 2030 (Energetychna strategiya Ukrayiny do 2030 roku).* Kyiv, 2006

Only in certain very limited circumstances (e.g. due to the strategic nature of a project) could a project be approved even if it does not meet the CRH criteria, but in that case a very strong rational and a detailed sensitivity analysis is required to explain why the project is justified.

The required real rate of return applicable to this project, taking account of country-specific risks, is 11%. This rate has been applied in determining the financial viability of this project. It is noteworthy that this rate is less than the rate for Euro denominated finance in Ukraine.

Sub-step 2c. Calculation and comparison of financial indicators
In order to calculate the project IRR and arrive to the incremental net cash flows arising from the project, the savings related to switching from wet process to dry process, have been compared with the total incremental capital expenditure related to the project.

The construction of the dry kiln is planned to take place during 2007-2008, the dry kiln being fully operational in the beginning of 2009. Cost of investment is estimated at Euro 140 million and is based on site preparation requirements and quotations from potential suppliers. Detailed forecasts for a calculation period of the 10 first years of operation have been prepared, and the terminal value assigned to the project has been calculated with the annuity method for 20 years (assuming the project lifetime at 30 years). The projected DCF return (IRR) is expressed in Real terms (after average inflation).

The annual clinker production volume is based on a recent market estimate by CRH/Podilsky Cement. Forecasted savings of clinker are based on the current average kiln economy in Podilsky Cement versus the estimated energy consumption in the dry process. The coal price used in the calculation is an average price based on recent quotations (5/2006) from local coal mines. The electricity price is the current price in Khmelnitsky District and savings are based on Podilsky's current consumption versus the estimated consumption in the dry process. Some savings in natural gas consumption (heat generator of the coal mill) have also been included, and a two Euro per tonne of cement saving in maintenance costs has been factored in for the first three years of operation. For simplicity the calculation has been prepared in Euros, with average inflation included in the cash flows. As it is very difficult to forecast the future energy prices, a conservative approach has been used and the energy prices in the model are forecast to increase in line with the Euro inflation.

Project IRR	8.8 %
Hurdle Rate	11.0%

Table 5: The project return.

Conclusion:
The project IRR does not satisfy the CRH requirements i.e. the indicator does not meet the CRH hurdle rate. This indicates that the project is not financially attractive without JI assistance, and would not receive CRH Board approval, if presented to the Board at all.

Sub-step 2d. Sensitivity analysis
The sensitivity analysis has been performed by varying the following key assumptions:
- Volume of cement production
- Cost of investment
- Price of coal

The base case calculation was prepared with a market demand assumption of 2.5 million tonne cement per year starting from 2.4 million tonne in 2009 and continuing at 2.5 million tonne in 2010 and onwards. In the first upside scenario the cement sales volumes produced with dry process have been increased to 2.6 million tonne in 2009. In this scenario the returns would slightly improve (IRR 9.4%) but they would still not meet the hurdle rate. In the more pessimistic scenario the volumes have been decreased to 2.1 million tonne per year (0% growth from 2006 forecast volumes) and in this case the IRR would decrease to 6.7% respectively.

The project is very capital intensive and also sensitive to the investment cost. If the investment cost is decreased by 10% to total 126 million Euro instead of estimated 140 million Euro the returns improve (IRR 10.4%) but they will not reach the hurdle rate required. In the downside case the investment cost is estimated 10% higher (at 154 million Euro). In this alternative the IRR would decrease to 7.5%.

If the price of coal would increase by 4% instead of 2% (real increase 100% above the Euro inflation) annually throughout the calculation period the project returns would improve (as the investment case is based on savings achieved by lower energy consumption). In this favourable case the project IRR would remain slightly below the threshold (10.7%). In the opposite scenario no increases above the Euro inflation have been factored in the model and the project savings are considerably lower (IRR 7.0%).

Assumption	Volume up to 2,6Mtpa	Volume down to 2,1Mtpa	Investment cost down by 10%	Investment cost up by 10%	Coal price up by 10% yearly	Coal price up by 0% yearly
Project IRR %	9.4%	6.7%	10.4%	7.5%	10.7%	7.0%

Table 6: Results sensitivity analysis

Step 3. Barrier analysis

Prevailing practise and technological barriers:
Originally cement was produced in low technology, low capacity shaft kilns. In the late nineteenth century rotary kilns began to be utilised to make cement. Quality and capacity were the driving forces. At that time the technology to handle significant volumes of dry materials had not been developed, but wet technologies were available from the mining and mineral processing industries. Process designs therefore featured preparation of the raw materials in a slurry form.

In the Western market-based economies, continuous efforts were made to reduce the costs of cement production. The dry process had some considerable economic advantages and with the economic availability of X-Ray spectrometers in the 1960s, process understanding developed rapidly and the dry process became the standard. In the 1980's pre-calciner technology was developed where raw meal is calcined in a calciner, which is part of the pre-heater tower. This allows a much shorter kiln, enhanced quality control and improved kiln economy. Exceptions to the trend towards dry process technology are those plants where the moisture content of the raw materials is so high that it is not possible to handle them with conventional dry technologies.

In the Soviet Union, including Ukraine, the switch from a wet-to-dry process was not observed. This is can partly be explained by high moisture content of the limestone, chalks, clays and marls, subsidized energy prices and the absence of capital. As a consequence hardly any experience in dry technology in Ukraine exists, nor is the technology or skilled professionals available.

The prevailing practise of wet-based cement production and the absence of technological experience for a dry-based cement production constitute a barrier for the proposed project activity.

Access to domestic and international capital
Cement production is a capital intensive industry and any major investment would involve a significant investment. Ukraine has a weak credit sector with the availability of financing to the industrial sector of only 12% of the GDP compared to 43% in Estonia or 45% in Hungary[12]. It would be very difficult, if not impossible, for Podilsky Cement to find domestic finance for the 140 million Euro project. Due to the perceived high country risk of Ukraine obtaining international capital at reasonable terms would be difficult, also given the fact that the project involves technology that is new to Ukraine.

The absence of domestic and international financing possibility for Podilsky Cement constitutes a barrier for the proposed project activity.

Step 4: Common practise analysis
Wet production of cement is common practice in Ukraine and neighbouring Belarus and Russia. The available raw materials generally contain excessive moisture.

The most recently commissioned kilns in the immediate region are those successfully commissioned by OAO Krasnoselkmaterialy in 2000 and 2002. These reliable units are wet kilns with a total capacity of 900 000 tonnes per annum and use wet chalk as the main raw material.

In 1997, at Chelm, close to the Polish-Ukrainian border, Cementownia Chelm SA successfully commissioned a new kiln specially designed for the marl and limestones available in the area, which contain 22 – 25 % moisture. The kiln was not a conventional dry process system but featured a special dryer crusher to accommodate the wet materials.

No new cement kilns have been commissioned in Ukraine in recent years and Podilsky Cement is not aware of new kiln projects in the design or implementation phase.

The proposed JI project activity is not common practice.

Step 5. Impact of JI registration

Alleviation of economic and financial hurdles (step 2)
For the purpose of demonstration additionality, a price of 15 Euro per ERU, was taken which is conservative. This price is below the observed EUA 2008 price of around 20 Euro in spring 2006.

The following results were obtained:

	Base Case without JI	Base case with JI	CRH benchmark
Project IRR %	8.8%	11.9%	11.0%

Table 7: Impact of JI registration on the financial indicators

[12] EBRD and Economist Intelligence Unit, issue 26 November 2005

Alleviation of barriers (step 3)
The mother company CRH has been operating dry process plants in Europe for more than four decades. The necessary experience in constructing and operating dry-process plant is available within the CRH group of companies. Part of the investment will be an extensive training of the employees of Podilsky Cement in all disciplines.

Conclusion
The registration of the proposed JI activity will:
- Make the largest single investment in the Ukrainian cement industry possible since independence;
- Give the Podilsky Cement access to the necessary technology and experience.

Conclusion: the impact of the proposed JI project activity will alleviate the economic/financial hurdle and will alleviate barriers to the project. The project is additional.

B.3. Description of how the definition of the project boundary is applied to the project:

There are three different sources of GHG emissions while producing cement:
- Fuel combustion;
- Geogenic emission from the calcination process;
- GHG emission in the Ukrainian grid as a result of electricity consumption.

In the table below an overview of all emission sources in the cement production process are given. The following approach has been used in determining whether they have been included in the project boundary:
- All sources of emissions that are not influenced by the project have been excluded;
- All sources of emissions that are influenced by the project have been included.

No	Source	Gas[13]			Justification/Explanation
1	Change in fuel consumption at the quarry and raw material transport	CO_2	Direct	Excluded	• Fossil fuel consumption will not be influenced by the project
2	Change in grid electricity consumption at the quarry and raw material transport	CO_2	Indirect	Excluded	• Electricity consumption will not be influenced by the project
3	Change in grid electricity consumption at the raw milling preparation: Wet: Wet slurry basins Dry: Pre-homogenisation, raw milling and homogenisation	CO_2	Indirect	Included	• The electricity consumption will decrease • Emissions calculated using standardized electricity baseline Ukraine[14]
4	Change in electricity consumption of the kiln[15] (e.g. motors for rotation)	CO_2	Indirect	Included	• The electricity consumption will decrease • Emissions calculated using standardized electricity baseline Ukraine
5	Change in fossil fuel combustion in kiln	CO_2	Direct	Included	• The fossil fuel combustions will decrease
6	Change in grid electricity consumption at the coal mill	CO_2	Indirect	Included	• The electricity consumption will decrease • Emissions calculated using standardized electricity baseline Ukraine
7	Natural gas combustion to dry the coal (baseline scenario only)	CO_2	Direct	Included	• In the project scenario the exhaust heat of the dry kiln will be used to dry the coal
8	Change in geogenic emission (calcination)	CO_2	Direct	Excluded	• The geogenic emissions will not be influenced by the project[16]
9	Change in grid electricity consumption at the cement mill, adding mineral components and packaging	CO_2	Indirect	Excluded	• Electricity consumption will not be influenced by the project.

Table 8: Sources of emissions

[13] Only CO_2 emissions are taken into account. CH_4 and N_2O emission reduction. This is conservative. Please refer also to the general remarks in section D.1.

[14] Podilsky Cement does not have own facilities to generate electricity.

[15] The kiln department includes the clinker cooler

[16] Clinker quality requires a specific concentration of CaO. This will be the same in the wet and the dry process. The change in ash absorbed will be balanced by an increase in the silica rich components, leaving geogenic emissions unchanged.

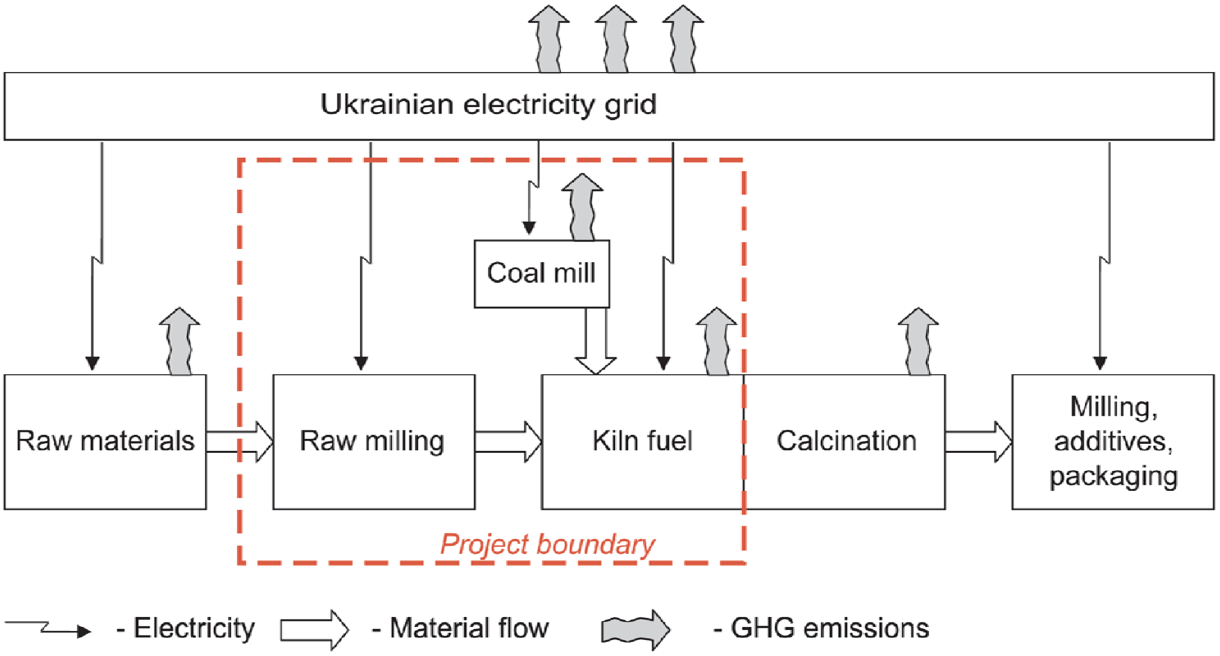

Figure 6: Sources of emissions and project boundary[17]

Please see section E for detailed data of the emissions within the project boundary.

B.4. Further baseline information, including the date of baseline setting and the name(s) of the person(s)/entity(ies) setting the baseline:

Date of completion of the baseline study: 29 August 2006

Name of person/entity determining the baseline:

- JSC Podilsky Cement
- Global Carbon B.V.

See Annex 1 for detailed contact information.

[17] The GHG emissions from the coal mill are a result of natural gas combustion in the heat generator and not from coal combustion.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Date of commissioning: not earlier than 1 January 2009.

Please note that commissioning of the project is envisaged during the first months of 2009, but not earlier than 1/1/2009. One of the key factors determining the investment decision and, as a consequence, the date of commissioning, is JI project approval. For the purpose of setting the length of the crediting period the most optimistic scenario, being 1 January 2009, has been selected.

C.2. Expected operational lifetime of the project:

At least 30 years.

Essentially this is a project for a kiln and raw mill system. The lifetime achieved of such systems is in excess of 30 years, with many examples exceeding 40 years. Operating dry process kilns within the CRH group include the following:

Name of Plant	Country	Kiln	Age
Platin Works	Ireland	No. 1	35 yrs
Platin Works	Ireland	No. 2	30 yrs
Secil Outao	Portugal	No. 8	30 yrs
Parainen	Finland	No. 6	32 yrs
Cibra Pataias	Portugal	No. 3	34 yrs
Cibra Pataias	Portugal	No. 2	46 yrs
Cornaux	Switzerland	No. 1	41 yrs

Table 9: Some examples of operating dry process kilns within the CRH Group

C.3. Length of the crediting period:

Within the first commitment period:
- Four years (1/1/2009 – 31/12/2012)

Within any relevant agreement under the UNFCCC from 2013 onwards:
- For the duration of the agreement but not more than the remaining operational lifetime of the project (twenty six years)[18]

---

[18] As discussed by the JISC in its third meeting.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

As elaborated in section B.3 the project activity only affects the emissions related to the kiln fuel, the electricity consumption of the raw milling, the kilns and the coal mill, plus the emission from the heat generator of the coal mill. For the purpose of establishing the baseline emissions and to monitor the project emissions, only these emissions will be monitored. Please note that, as part of the in-house reporting system at Podilsky Cement, all emissions are monitored using the WBCSD “CO2 Emissions Monitoring and Reporting Protocol for the Cement Industry”.

Applicability:

- The amount of clinker produced is not influenced by the project;
- In the baseline scenario the production capacity would be sufficient to meet the production in the project scenario;
- The emissions at the quarry and raw materials are not influenced by the project;
- The type of fossil fuel combusted in the kiln is not influenced by the project;
- Geogenic emissions do not change;
- The emissions after clinker production are not influenced by the project.
- No legal requirement exists to implement the switch from wet to dry;

General remarks:

- In consultation with the verifier, the monitoring plan will be updated prior to the commissioning of the project;
- The operating indicators of the dry kiln will be monitored by Podilsky Cement as part of their in-house reporting system. The values will be submitted to the validator if required: number of kiln run hours, number of kiln stops for planned overhauls, number of hours for planned kiln stops, number of market stops, number of hours for market stops, number of short stops less than 24 hours, hours lost during short stops;
- Social indicators such as number of people employed, safety record, training records, etc, will be available to the verifier if required;
- Environmental indicators such as dust emissions, NOx, or SOx will be available to the verifier if required;
- In the event of quantities of other fuels being used, e.g. petcoke, the monitoring plan will be adjusted with the identical monitoring strategy, as used for coal;
- Should the wet kiln need to be restarted, as described in section A.4.2, the emissions of the old system will be monitored accordingly.
- To allow commissioning of the raw mill system, a heat generator will be installed to allow the raw mill produce the first rawmeal before the kiln start. Conventionally, this heat generator is not required thereafter. It is not included in the project monitoring plan. In the event of its operation being required thereafter, it will be added to the plan.
- For the greenhouse gas emissions only the CO_2 emissions are taken into account. Cement kilns normally have a CH_4 emission of 0.06 g/kg of clinker and N2O emissions of 0.001 g/kg of clinker compared with more than 650 g CO2 / kg of clinker. Omitting these two emissions for a cement kiln is conservative,

because they contribute to less than 0.01% of the total emissions, far below the confidence level for the CO2 data calculations. This is confirmed in the VDZ Environmental Report 2001 (English) and 2004 (German). The CH_4 and N_2O emission reductions will not be claimed. This is conservative.

D.1.1. Option 1 – Monitoring of the emissions in the project scenario and the baseline scenario:

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how this data will be archived:								
ID number (Please use numbers to ease cross-referencing to D.3)	**Data variable**	**Source of data**	**Data unit**	**Measured (m), calculated (c) or estimated (e)**	**Recording frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic/ paper)**	**Comment**
P1	PE_y	Plant records	tCO_2	c	Annually	100%	Electronic	
P2	$PE_{kiln,y}$	Plant records	tCO_2	c	Annually	100%	Electronic	
P3	$PE_{rwmkln,y}$	Plant records	tCO_2	c	Annually	100%	Electronic	
P4	$PE_{coalmill,y}$	Plant records	tCO_2	c	Annually	100%	Electronic	
P5	$FF_{kiln,y}$	Plant records	tonne	c	Annually	100%	Electronic	
P6	$EF_{el,y}$	Plant	tCO_2/	c	Fixed	100%	Electronic	Baseline carbon emission factors for JI projects

[19] "Operational Guidelines for Project Design Documents of Joint Implementation Projects", Version 2.3

		records	MWh		value			reducing electricity consumption[19]. See annex 2. Should a new standardized baseline for Ukraine be adopted, the baseline carbon emission factor will be changed accordingly.
P7	$EF_{ff,y}$	Plant records	tCO_2/ GJ	m/c	Per shipment	100%	Electronic	Weighted average of all shipments will be taken over a calendar year.
P8	$EL_{rwmkln,y}$	Plant records	MWh	m	Continuously	100%	Electronic	The monitoring of electricity consumption in the new plant at Podilsky will be designed consistent with the monitoring plan. Calibration frequency will be in accordance with instructions of suppliers.
P9	$EL_{coalmill,y}$	Plant records	MWh	m	Continuously	100%	Electronic	The monitoring of electricity consumption in the new plant at Podilsky will be designed consistent with the monitoring plan. Calibration frequency will be in accordance with instructions of suppliers.
P10	PRC_y	Plant records	tonne	m	Annually	100%	Electronic	
P11	$COAL_{stkend,y}$	Plant records	tonne	m	Annually	100%	Electronic	
P12	$COAL_{stkbgn,y}$	Plant records	tonne	m	Annually	100%	Electronic	
P13	$NCV_{ff,y}$	Plant records	GJ/ tonne	m/c	Per shipment	100%	Electronic	Weighted average of all shipments will be taken over a calendar year.

Table 10: Data to be collected in order to monitor emissions from the project

D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

$$PE_y = PE_{kiln,y} + PE_{rwmkln,y} + PE_{coalmill,y} \quad (1)$$

Where:

PE_y	Project emissions in year y (tCO2)
$PE_{kiln,y}$	Project emissions of kiln fuel in year y (tCO2)
$PE_{rwmkln,y}$	Project emissions of electricity consumption of raw milling and kiln in year y (tCO2)
$PE_{coalmill,y}$	Project emissions of electricity consumption of coal mill in year y (tCO2)

Kiln fuel

$$PE_{kiln,y} = FF_{kiln,y} \times EF_{ff,y} \times NCV_{ff,y} \quad (2)$$

Where:

$PE_{kiln,y}$	Project emissions of kiln fuel in year y (tCO2)
$FF_{kiln,y}$	Quantity of kiln fuel combusted in year y (tonne)
$EF_{ff,,y}$	Carbon emission factor of kiln fuel in year y (tCO2/GJ)
$NCV_{ff,y}$	Net Calorific Value of kiln fuel in year y (GJ/tonne)

Electricity consumption raw milling and kiln

$$PE_{rwmkln,y} = EF_{el,y} \times EL_{rwmkln,y} \qquad (3)$$

Where:

$PE_{rwmkiln,y}$	Project emissions of electricity consumption of raw milling and kiln in year y (tCO2)
$EF_{el,y}$	Carbon emission factor of Ukrainian grid in year y (tCO2/MWh)
$EL_{rwmkln,y}$	Electricity consumption of raw milling and kiln in year y (MWh)

Electricity consumption coal mill

$$PE_{coalmill,y} = EF_{el,y} \times EL_{coalmill,y} \qquad (4)$$

Where:

$PE_{coalmill,y}$	Project emissions of electricity consumption of coal mill in year y (tCO2)
$EF_{el,y}$	Carbon emission factor of Ukrainian grid in year y (tCO2/MWh)
$EL_{rawmill,y}$	Electricity consumption of coal mill in year y (MWh)

Heat generator of coal mill
In the project scenario the waste heat of the kiln will be utilized to dry the coal. Therefore no heat generator of the coal mill will be in operation under the project scenario but will be in the baseline scenario. Refer to section D.1.1.4.

Quantity of coal combusted during a year
The amount of combusted coal in the kiln will be calculated as the total amount of coal purchased during a calendar year, including difference between the amount of stocks at the end of the year and stocks in the beginning of the year.

$$FF_{kiln,y} = PRC_y - COAL_{stkend,y} + COAL_{stkbgn,y} \qquad (5)$$

Where:

$FF_{kln,y}$ the amount of coal combusted in kiln in year y (tonne)

PRC_y the amount of coal purchased during the year y (tonne)

$COAL_{stkend,y}$ the amount of coal stocks at the end of the year y (tonne)

$COAL_{stkbgn,y}$ the amount of coal stocks at the beginning of the year y (tonne)

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary, and how such data will be collected and archived:

ID number (Please use numbers to ease cross-referencing to table D.3)	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
B1	BE_y	Plant Records	tCO_2	c	Annually	100%	Electronic	
B2	$BE_{kiln,y}$	Plant Records	tCO_2	c	Annually	100%	Electronic	
B3	$BE_{rwmkln,y}$	Plant Records	tCO_2	c	Annually	100%	Electronic	
B4	$BE_{coalmill,y}$	Plant Records	tCO_2	c	Annually	100%	Electronic	

B5	$BE_{heatgen,y}$	Plant Records	tCO_2	c	Annually	100%	Electronic	
B6	BKE	Plant Records	GJ/t clinker	c	Fixed value	100%	Electronic	This value has been fixed using the average of 2003, 2004 and 2005 and subsequently reduced to be conservative. See annex 2.
B7	$CLNK_y$	Plant Records	tonne	c	Annually	100%	Electronic	
B8	$EF_{el,y}$	Plant Records	tCO_2/ MWh	c	Fixed value	100%	Electronic	Baseline carbon emission factors for JI projects reducing electricity consumption[20]. See annex 2. Should a new standardized baseline for Ukraine be adopted, the baseline carbon emission factor will be changed accordingly.
B9	$BELE_{rwmkln}$	Plant Records	tCO_2	c	Fixed value	100%	Electronic	This value has been fixed by taking the measured value of the year 2005 (most conservative). See annex 2.
B10	PKE_y	Plant Records	GJ/t clinker	c	Annually	100%	Electronic	
B11	$BFF_{heatgen}$	Plant record	1000 Nm^3/ tonne coal	c	Fixed value	100%	Electronic	This value will be fixed using the average consumption of the heat generator in 2007 and 2008 (= before commissioning of the project). See B31 and annex 2.

[20] "Operational Guidelines for Project Design Documents of Joint Implementation Projects", Version 2.3

B12	$EF_{ng,y}$	IPCC	tCO_2/ GJ	c	Fixed value	100%	Electronic	IPCC default = 56.1 tCO_2/GJ
B13	$FF_{kiln,y}$	Plant Records	tonne	c	Annually	100%	Electronic	
B14	CEM_y	Plant Records	tonne	c	Annually	100%	Electronic	
B15	MIN_y	Plant Records	tonne	c	Annually	100%	Electronic	
B16	$EL_{coalmill,y}$	Plant Records	MWh	m	Continuously	100%	Electronic	
B17	$EF_{ff,y}$	Plant Records	tCO_2/ GJ	m/c	Per shipment	100%	Electronic	Weighted average of all shipments will be taken over a calendar year.
B18	$NCV_{ff,y}$	Plant records	GJ/ tonne	m/c	Per shipment	100%	Electronic	Weighted average of all shipments will be taken over a calendar year.
B19	$NCV_{ng,y}$	Plant records	GJ/ 1000 Nm^3	m	Annually	100%	Electronic	
B20	$CLNK_{stkend,y}$	Plant Records	tonne	m	Annually	100%	Electronic	
B21	$CLNK_{stbgn,y}$	Plant Records	tonne	m	Annually	100%	Electronic	
B22	$CLNK_{purchased,y}$	Plant Records	tonne	m	Annually	100%	Electronic	

B23	$CLNK_{sold,y}$	Plant Records	tonne	m	Annually	100%	Electronic	
B24	$PRMIN_y$	Plant Records	tonne	m	Annually	100%	Electronic	
B25	$MIN_{stkend,y}$	Plant Records	tonne	m	Annually	100%	Electronic	
B26	$MIN_{stkbgn,y}$	Plant Records	tonne	m	Annually	100%	Electronic	
B27	$LMST_y$	Plant Records	tonne	m	Per Production	100%	Electronic	
B28	SLS_y	Plant Records	tonne	m	Annually	100%	Electronic	
B29	$CEM_{stkend,y}$	Plant Records	tonne	m	Annually	100%	Electronic	
B30	$CEM_{stkbgn,y}$	Plant Records	tonne	m	Annually	100%	Electronic	
B31	$FF_{heatgen,y}$	Plant Records	1000 Nm3	m	Continuously	100%	Electronic	Measurements in years 2007 & 2008 are required for establishing $BFF_{heatgen}$. See B11 and Annex 2. The monitoring of gas consumption in the heat generator using a gas flow meter will be designed consistent with the monitoring plan.

Table 11: Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary

D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

$$BE_y = BE_{kiln,y} + BE_{rwmkln,y} + BE_{coalmill,y} + BE_{heatgen,y} \quad (6)$$

Where:

BE_y	Baseline emissions in year y (tCO2)
$BE_{kiln,y}$	Baseline emissions of kiln fuel in year y (tCO2)
$BE_{rwmkln,y}$	Baseline emissions of electricity consumption of raw milling and kiln in year y (tCO2)
$BE_{coalmill,y}$	Baseline emissions of electricity consumption of coal mill in year (tCO2)
$BE_{heatgen,y}$	Baseline emissions of heat generator of coal mill (tCO2)

Kiln fuel

The baseline emissions from the combustion of the kiln fuel are calculated by multiplying the amount of clinker produced with the emission factor of the fossil fuel (in tCO2/GJ) and the baseline kiln economy. The kiln economy is a stable figure with small variations over the years. Therefore, the baseline kiln economy BKE can be established by extrapolating the average of the most recent available measure values of the years 2003, 2004 and 2005 (=6.771 GJ/t clinker). In order to be conservative BKE is reduced to 6.684 GJ/t clinker (=1600 Kcal/kg clinker). This value also represents a standard factor used in the cement industry. Refer to Annex 2.

$$BE_{kiln,y} = EF_{ff,y} \times BKE \times CLNK_y \quad (7)$$

Where:

$BE_{kiln,y}$	Baseline emissions of kiln fuel in year y (tCO2)
$EF_{ff,y}$	Carbon emission factor of kiln fuel in year y (tCO2/GJ)

BKE	Baseline kiln economy (GJ/t clinker)
$CLNK_y$	Amount of clinker produced in year y (tonne)

Electricity consumption raw milling and kiln

The baseline emissions from the consumption of electricity of raw milling and the kilns are calculated by multiplying the amount of clinker produced with the grid electricity baseline and the baseline electricity consumption. The grid electricity baseline $EF_{el,y}$ is based on the standardised electricity baseline of the Dutch Ministry of Economic Affairs. The baseline electricity consumption $BELE_{rwmkln}$ has been established by extrapolating historic measured consumption. Due to wear out of the equipments, the specific electric consumption will increase in the baseline scenario. Therefore, taking a fixed value instead is conservative. Only measurement in the year 2005 has been used as, due to investment in a more efficient compressor system, power consumption in 2005 was lower than previous years. Therefore taking measurement of 2005 only is conservative. Refer to Annex 2.

$$BE_{rwmkln,y} = EF_{el,y} \times BELE_{rwmkln} \times CLNK_y \qquad (8)$$

Where:

$BE_{rwmkln,y}$	Baseline emissions of electricity consumption of raw milling and kilns in year y (tCO2)
$EF_{el,y}$	Carbon emission factor of Ukrainian grid in year y (tCO2/MWh)
$BELE_{rwmkln}$	Baseline electricity consumption of raw milling and kiln (MWh/t clinker)
$CLNK_y$	Amount of clinker produced in year y (tonne of clinker)

Electricity consumption coal mill

In the baseline scenario the coal mill would have to mill more coal than compared to the project scenario for the same amount of produced clinker. Therefore the baseline emissions are calculated by monitoring the actual electricity consumption of the coal mill and multiply it with the quotient of the baseline kiln economy and the project kiln economy.

$$BE_{coalmill,y} = \frac{BKE}{PKE_y} \times EF_{el,y} \times EL_{coalmill,y} \qquad (9)$$

Where:

$BE_{coalmill,y}$	Baseline emissions of electricity consumption of the coal mill in year y (tCO2)
BKE	Baseline kiln economy (GJ/t clinker)
PKE_y	Project kiln economy per tonne of clinker in year y (GJ/t clinker)
$EF_{el,y}$	Carbon emission factor of Ukrainian grid in year y (tCO2/MWh)
$EL_{coalmill,y}$	Electricity consumption of coal mill in year y (MWh)

$$PKE_y = \frac{FF_{kiln,y} \times NCV_{ff,y}}{CLNK_y} \qquad (10)$$

Where:

PKE_y	Project kiln economy in year y (GJ/t clinker)
$FF_{kiln,y}$	Quantity of fossil fuel burnt in kiln in year y (tonne)
$NCV_{ff,y}$	Net calorific value of fossil fuel burnt in kiln in year y (GJ/tonne)
$CLNK_y$	Amount of clinker produced in year y (tonne of clinker)

Heat generator of coal mill

In the baseline scenario no exhaust gases of the dry kiln can be utilised as a source of energy[21]. Therefore in the baseline scenario a heat generator will be installed fuelled by natural gas. The heat generator will start operating with the commissioning of the coal mill in autumn 2006 and will continue to operate under the baseline scenario. The baseline specific fuel consumption of the heat generator $BFF_{heatgen}$ will be established by taking the measured values of the years

[21] The moisture content of exhaust gases from wet kilns is very high due to the evaporation of water from the slurry. It is not possible to use such saturated gases for coal drying.

2007 and 2008. Refer to annex 2.

$$BE_{heatgen,y} = FF_{kiln,y} \times BFF_{heatgen} \times EF_{ng,y} \times NCV_{ng,y} \qquad (11)$$

Where:

$BE_{heatgen,y}$ Baseline emissions of heat generator in year y (tCO2)

$FF_{kiln,y}$ Quantity of fossil fuel burnt in kiln in year y (tonne)

$BFF_{heatgen}$ Baseline specific fuel consumption of heat generator (1000 Nm3/tonne coal)

$EF_{ng,y}$ Carbon emission factor natural gas in year y (tCO2/GJ)

$NCV_{ng,y}$ Net calorific value of natural gas in year y (GJ/1000 Nm3)

Quantity of clinker produced during a year

The amount of clinker produced is measured from kiln feed measurement, but not accurately enough for the purpose of monitoring the emissions of GHG. Therefore $CLNK_y$ is calculated using the data on cement sales minus mineral components added, with a correction for a change in the clinker stocks at the end of a calendar year corrected for purchased and sold clinker. The quantity of clinker is calculated by using the following formula:

$$CLNK_y = CEM_y - MIN_y + CLNK_{stkend,y} - CLNK_{stkbgn,y} - CLNK_{purchased,y} + CLNK_{sold,y} \qquad (12)$$

Where:

$CLNK_y$ amount of clinker produced in year y (tonne)

CEM_y amount of cement produced in year y (tonne)

MIN_y amount of mineral additives used in cement production in year y (tonne)

$CLNK_{stkend,y}$ amount of clinker stocks at the end of year y (tonne)

$CLNK_{stkbgn,y}$ amount of clinker stocks at the beginning of year y (tonne)

$CLNK_{purchased,y}$ amount of clinker purchased in year y (tonne)

$CLNK_{sold,y}$ amount of clinker sold in year y (tonne)

The amount of mineral additives used during a year MIN_y is calculated using the data on mineral additives purchased and the surveyed clinker stocks in the beginning and the end of a year. One exception is made for limestone as the purchased limestone is used both for clinker production and as a mineral component. The amount of limestone added as a mineral component will therefore be measured by taking regular samples of the cement. Please refer to section D.2 for a detailed description how the different values will be measured.

$$MIN_y = PRMIN_y - MIN_{stkend,y} + MIN_{stkbgn,y} + LMST_y \qquad (13)$$

Where:

MIN_y	amount of mineral additives used in cement production in year y (tonne)
$PRMIN_y$	amount of mineral additives purchased in year y (tonne)
$MIN_{stkend,y}$	amount of mineral additives stocks at the end of year y (tonne)
$MIN_{stkbgn,y}$	amount of mineral additives stocks at the beginning of year y (tonne)
$LMST_y$	amount of limestone added in year y (tonne)

The amount of cement produced during a year is measured by cement mill feed, but not accurately enough for the purpose of monitoring the emissions of GHG. Therefore CEM_y is measured by using the data on cement sales as this provides to most accurate measurement. As produced cement is not necessarily immediatly sold, the figure will be corrected for a change in the cement stocks at the end of a year.

$$CEM_y = SLS_y - CEM_{stkend,y} + CEM_{stkbgn,y} \qquad (14)$$

Where:

CEM_y	amount of cement produced in year y (tonne)
SLS_y	cement sales in year y (tonne)
$CEM_{stkend,y}$	cement stocks at the end of year y (tonne)
$CEM_{stkbeg\ ,y}$	cement stocks in the beginning of year y (tonne)

D. 1.2. Option 2 – Direct monitoring of emission reductions from the project (values should be consistent with those in section E.):

Not applicable

D.1.2.1. Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

Not applicable

D.1.3. Treatment of leakage in the monitoring plan:

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO_2 equivalent):

Due to reduced coal consumption, fewer emissions will occur in the coal mining and the transport to the factory. This leakage has not been taken into account for simplification and to be conservative. Other leakage was not identified.

D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

$$ER_y = BE_y - PE_y \quad (15)$$

Where:

ER_y Emission reductions of the JI project in year y (tCO2e)
BE_y Baseline emissions in year y (tCO2e)
PE_y Project emissions in year y (tCO2e)

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the project:

Atmospheric emissions are the only important source of pollution at Podilsky Cement that has an impact on the local environment. According to the national requirements, atmospheric emissions have to be measured by making samples on the quarterly basis. Podilsky Cement systematically collects data on the pollutants that have an impact on the local environment. Currently (as of June 2006) the laboratory of Podilsky Cement is making measurements of the following emissions:

Gaseous pollutants (NOx & SOx)

Gaseous pollutants are measured by means of gas spectrometer installed at the wet kiln #1. Gaseous emissions at the wet kiln #1 are measured constantly on real-time basis. The remaining three wet kilns measure the gaseous emissions periodically every three months by taking samples with a mobile gas spectrometer. Both gas spectrometers used by the laboratory of Podilsky Cement are monitoring the levels of carbon monoxide and NOx emissions. Currently there are no emissions of SOx at Podilsky Cement, but the existing gas spectrometers would measure SOx emissions should they appear.

Dust emissions
The emissions of dust are measured by the laboratory of Podilsky Cement using the weighing method. The level of dust is being measured by weighing a filter installed for a certain time in the exhaust air flow. Samples are taken on a quarterly basis.

Monitoring at dry kiln
In case of the proposed JI project four existing wet kilns will be mothballed, and only the new dry kiln will be in operation. The existing scheme of air pollution measurement will be used in the project scenario. In this case, the gaseous pollutants (NOx and SOx, if any) will be measured on a real-time basis by the existing gas spectrometer that will be installed on the new dry kiln. Dust measurements will be made by the plant's laboratory using the weighing method on the quarterly basis.

D.2. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored:

Data (Indicate table and ID number e.g. 3.-1.; 3.2.)	**Data variable**	**Uncertainty level of data (%)**	**Explain QA/QC procedures planned for these data, or why such procedures are not necessary.**
Table 10			
P7	$EF_{ff,y}$	0.5%	An independent certification company will take samples of each shipment of coal and will issue a certificate of the Carbon Emission Factor (and the Net Calorific Value) of each shipment. The laboratory department will store these certificates and will calculate the weighted average value of the Carbon Emission Factor (and the Net Calorific Value) at the end of each year.
P8	$EL_{rwmkln,y}$	1%	Individual electricity meters will be installed at the raw mill and kiln system, enabling continuous measurement of the electricity consumption. Electricity meters are calibrated at least once in three years by an authorized organization or more often if instructed so by the hardware supplier. The data of these meters will supplied by the energy department to the Laboratory department.

P9	$EL_{coalmill,y}$	See P8	Please refer to P8
P10	PRC_y	0.2% (weighbridge)	Each shipment of coal will be accompanied with documentation on the amount of delivered coal by the coal supplier. This documentation is in the form of invoices and acts of acceptance. The information is obtained by the accounting department and will be transferred to the laboratory department. The delivered coal will be cross-checked by measuring each shipment on a weighbridge at Podilsky Cement. Weighbridges are calibrated once a year by qualified personnel.
P11	$COAL_{stkend,y}$	1%*	The coal stocks are surveyed on an annual basis at the end of a calendar year. The survey will be performed by an in-house team of Podilsky Cement. The survey is supervised by an external accountant, which also approves the survey. This procedure is in accordance with Ukrainian legislation.
P12	$COAL_{stkbgn,y}$	See P12	Opening stock of coal is same as closing stock of previous year. Please refer to P11.
P13	$NCV_{ff,y}$	0.5%	An independent certification company will take samples of each shipment of coal and will issue a certificate as described under P7. The laboratory department will store these certificates and will calculate the weighted average value of the Net Calorific Value at the end of each year.
Table 11			
B16	$EL_{coalmill,y}$	See P8	Please refer to P8.
B17	$EF_{ff,y}$	See P7	Please refer to P7.
B18	$NCV_{ff,y}$	See P13	Please refer to P13
B19	$NCV_{ng,y}$	<0.5%	Net calorific value of the natural gas is measured by the laboratory of the Gas Transportation System of Ukraine and supplied to Podilsky Cement.

B20	$CLNK_{stkend,y}$	1%*	The clinker stocks are surveyed on an annual basis at the end of a calendar year. The survey will be performed by an in-house team of Podilsky Cement. The survey is supervised by an external accountant, which also approves the survey. This procedure is in accordance with Ukrainian legislation.
B21	$CLNK_{stbgn,y}$	See B20	As opening stock is identical to closing stock of the previous year, please refer to B20.
B22	$CLNK_{purchased,y}$	0.2% (weigh bridges)	Each shipment of purchased clinker will be accompanied with documentation on the amount of delivered coal by the coal supplier. This documentation is in the form of invoices and acts of acceptance. The information is obtained by the accounting department and will be transferred to the laboratory department. The actual weight of each shipment will be cross-checked by means of weighbridges.
B23	$CLNK_{sold,y}$	See B22	Please refer to B22
B24	$PRMIN_y$	0.2% (weigh bridges)	Each shipment of purchased mineral components will be accompanied with documentation on the amount of delivered coal by the coal supplier. This documentation is in the form of invoices and acts of acceptance. The information is obtained by the accounting department and will be transferred to the laboratory department. This data will be cross-checked with the results of cement content analysis made by the laboratory of Podilsky Cement on a regular basis.
B25	$MIN_{stkend,y}$	1%*	The mineral stocks are surveyed on an annual basis at the end of each calendar year. The survey will be performed by an in-house team of Podilsky Cement. The survey is supervised by an external accountant, which also approves the survey. This procedure is in accordance with Ukrainian legislation.
B26	$MIN_{stkbg,y}$	See B25	As opening stocks are the same a closing stock of the previous year, please refer to B25
B27	$LMST_y$	1.2%	The amount of Limestone is measured by the Laboratory that takes regular samples of the cement. Based on these samples the amount of limestone added is calculated.

B28	SLS_y	0.2% (weigh bridges)	The amount of annual cement sales will be taken from financial data of stated in the purchase contract and the final acts of acceptance. The actual weight of each shipment will be cross-checked by means of weighbridges.
B29	$CEM_{stkend,y}$	1%*	The cements stocks are surveyed on an annual basis at the end of each calendar year. The survey will be performed by an in-house team of Podilsky Cement. The survey is supervised by an external accountant, which also approves the survey. This procedure is in accordance with Ukrainian legislation.
B30	$CEM_{stkbgn,y}$	See B29	Please refer to B29
B31	$FF_{heatgen,y}$	<1%	The volumes of natural gas consumed by the heat generator will be measured by means of the TERZ 94 gas meter. The meter has to be maintained every three months for lubrication. Calibration procedure is done every year by an authorized organization.

** Due to the repetitive character of the survey of the stocks, the overall uncertainty level is much lower.*

Table 12: Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Internal quality system at Podilsky Cement

The internal quality system at Podilsky Cement is functioning in accordance with the national standards. The quality of cement is continuously controlled by the laboratory of the plant. The laboratory is certified by the National Accreditation Agency of Ukraine with DSTU ISO/IEC 17025-2001 certificate. The laboratory of Podilsky Cement holds responsibility and functions of quality control manager in terms of compliance with DSTU ISO/IEC 17025-2001.

D.3. Please describe the operational and management structure that the project operator will apply in implementing the monitoring plan:

Three departments of Podilsky Cement will be responsible for collecting the information for monitoring purposes.

The laboratory of Podilsky cement

The laboratory of Podilsky Cement, in general responsible for quality control of cement, will hold the overall responsibility for implementation of the monitoring plan, like organizing and storing the data and calculation the emission reductions. The laboratory will also prepare the annual Monitoring Protocols, to be presented to a Verifier of the emission reductions. Other departments of Podilsky Cement will submit relevant data to the laboratory for the monitoring purposes.

The laboratory is, and will be, responsible for the direct measurements of the amount of mineral additives used in cement and limestone used as an additive to cement for cross-checking the data from the accounting department.

In addition to the preparation of the Annual Monitoring Protocols, the laboratory will conduct an internal audit annually to assess project performance and if necessary make corrective actions.

Energy department
The energy department is responsible for control of fuel and electricity consumption at Podilsky Cement. It collects data from the individual electricity meters installed at the production units that consume electricity, and the data of the commercial electricity meter that belongs to the regional power distribution company and measures the overall electricity consumption at the plant. The data from individual electricity meters is cross-checked with the data of the commercial meter. For the purposes of monitoring, the energy department will report electricity consumption level of the kiln system and the raw milling system, and provide it to the laboratory.

Accounting department
The accounting department of Podilsky Cement is responsible for collecting the data of purchased and sold materials and products. For the purpose of monitoring, the accounting department will submit to the laboratory of the Podilsky Cement the quantity of mineral additives purchased, the quantity of coal purchased, the quantity of clinker purchased and sold, and the data of the commercial electricity meter.

Apart of internal departments of Podilsky Cement, three independent external organizations will be contracted to provide the data necessary for monitoring plan implementation:

The laboratory of the Gas transportation system of Ukraine
The laboratory will provide data on the net calorific value of the natural gas consumed.

Independent certification body
This body will be contracted by Podilsky Cement to measure the net calorific value and the carbon emission factor of each shipment of coal.

Independent surveying company
This company will be contracted to supervise and approved the in-house survey of the opening (and closing) stocks of coal, cement, clinker, and mineral components.

The data from all external organizations will be collected by the laboratory of Podilsky Cement for monitoring purposes. For the usual routine procedures all the data has to be stored for three years for the purposes of the independent financial audit. For the purpose of the monitoring system implementation, the collected data will be stored by the Laboratory department at least for two years after the end of the crediting period – i.e. at least until 2014.

For a detailed description of each measured value, please refer to section D.2. The scheme of the data collection for monitoring purposes is presented below.

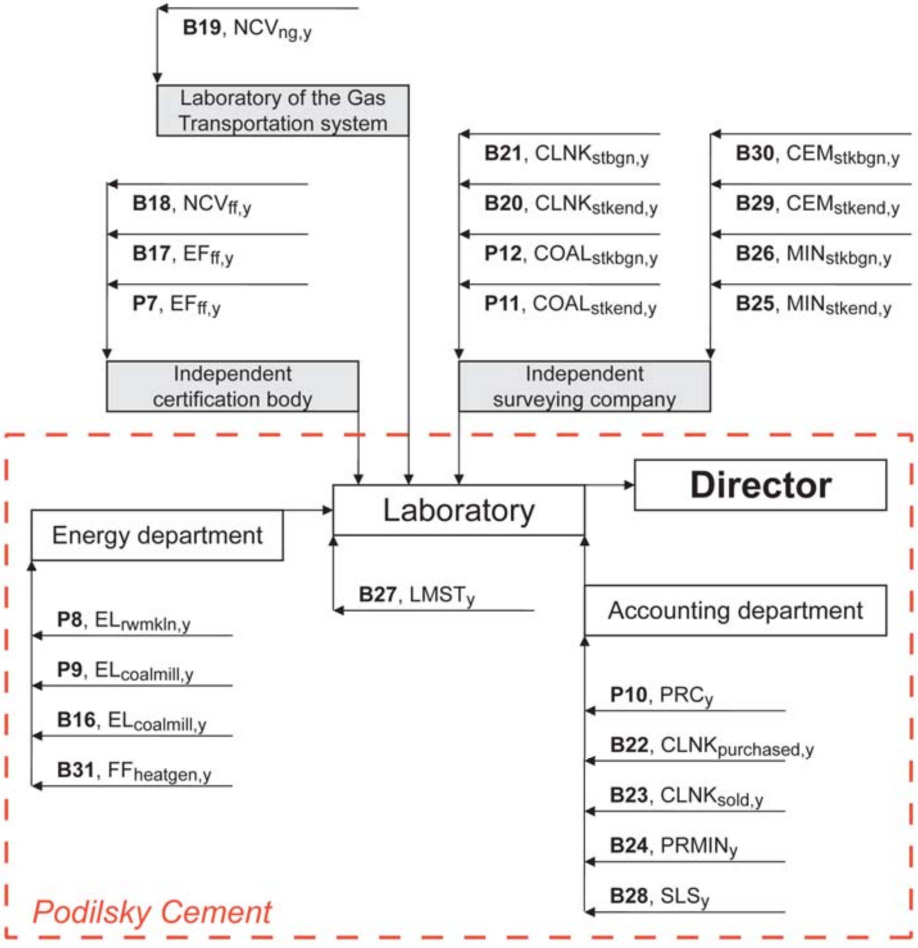

Figure 7: Scheme of data collection of the monitoring plan

D.4. Name of person(s)/entity(ies) establishing the monitoring plan:

- JSC Podilsky Cement
- Global Carbon B.V.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Project emissions			2008	2009	2010	2011	2012
1	Kiln fuel	[tCO2/yr]	1,343,689	639,315	665,875	665,875	665,875
2	Raw mill and kiln	[tCO2/yr]	113,986	97,117	98,684	96,205	93,725
3	Coal mill	[tCO2/yr]	9,252	4,430	4,501	4,388	4,275
4	Heat Generator	[tCO2/yr]	10,526	0	0	0	0
5	Total	[tCO2/yr]	1,477,453	740,862	769,060	766,467	763,875
6	Total 2008 - 2012	[tCO2]	4,517,717				

Table 13: Estimated project emissions

E.2. Estimated leakage:

0

E.3. The sum of E.1. and E.2.:

Project emissions			2008	2009	2010	2011	2012
1	Kiln fuel	[tCO2/yr]	1,343,689	639,315	665,875	665,875	665,875
2	Raw mill and kiln	[tCO2/yr]	113,986	97,117	98,684	96,205	93,725
3	Coal mill	[tCO2/yr]	9,252	4,430	4,501	4,388	4,275
4	Heat Generator	[tCO2/yr]	10,526	0	0	0	0
5	Total	[tCO2/yr]	1,477,453	740,862	769,060	766,467	763,875
6	Total 2008 - 2012	[tCO2]	4,517,717				

Table 14: Estimated project emissions

E.4. Estimated baseline emissions:

Baseline emissions			2008	2009	2010	2011	2012
7	Kiln fuel	[tCO2/yr]	1,343,689	1,343,689	1,399,598	1,399,598	1,399,598
8	Raw mill and kiln	[tCO2/yr]	113,986	111,259	113,054	110,213	107,373
9	Coal mill	[tCO2/yr]	9,252	9,030	9,176	8,945	8,715
10	Heat Generator	[tCO2/yr]	10,526	10,526	10,965	10,965	10,965
11	Total	[tCO2/yr]	1,477,453	1,474,504	1,532,792	1,529,721	1,526,650
12	Total 2008 - 2012	[tCO2]	7,541,120				

Table 15: Estimated baseline emissions

E.5. Difference between E.4. and E.3. representing the emission reductions of the project:

Reductions			2008	2009	2010	2011	2012
13	Kiln fuel	[tCO2/yr]	0	704,374	733,723	733,723	733,723
14	Raw mill and kiln	[tCO2/yr]	0	14,142	14,370	14,009	13,648
15	Coal mill	[tCO2/yr]	0	4,600	4,675	4,557	4,440
16	Heat Generator	[tCO2/yr]	0	10,526	10,965	10,965	10,965
17	Total	[tCO2/yr]	0	733,642	763,732	763,254	762,775
18	**Total 2008 - 2012**	[tCO2]	**3,023,403**				

Table 16: Difference representing the emission reductions of the project

E.6. Table providing values obtained when applying formulae above:

Year	Estimated project emissions (tonnes of CO_2 equ.)	Estimated leakage (tonnes of CO_2 equ.)	Estimated baseline emissions (tonnes of CO_2 equ.)	Estimated emission reductions (tonnes of CO_2 equ.)
Year 2008	1,477,453	0	1,477,453	0
Year 2009	740,862	0	1,474,504	733,642
Year 2010	769,060	0	1,532,792	763,732
Year 2011	766,467	0	1,529,721	763,254
Year 2012	763,875	0	1,526,650	762,775
Total (tonnes of CO_2 equ.)	4,533,273	0	7,541,120	3,023,403

Table 17: Overview of project, baseline, and emission reductions

Risks and uncertainties

The estimation of the emissions reductions of this project is based on several assumptions. The following factors are of influence of the actual emission reductions. Between brackets the assumptions are given that have been used for the estimation:

- Clinker production in 2009 – 2012 (2009: 2 million tonne; 2010-2012: 2.2 million tonne)
- Commissioning date of the project (1/1/2009)
- Kiln economy of dry kiln (3,180 MJ/t clinker)
- Carbon Emission Factor (0.096 tCO_2/GJ)
- Net Calorific Value of coal (25.104 GJ/t coal)

The first two assumptions are not within control of Podilsky Cement as clinker (cement) production depends on the development of the cement market in Ukraine and the commissioning data depends on obtaining JI approval. The other three factors have a higher certainty.

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundary impacts, in accordance with procedures as determined by the host Party:

Cement production has certain impact on the local environment. In Ukraine emission levels in industry are regulated by operating licenses issued by regional offices of the Ministry for Environmental Protection on the individual basis for every enterprise that has significant impact on the environment. The current levels of the emissions of the main pollutants (dust, sulphur oxides and nitrogen oxides), are in compliance with the requirements of the plant's operational license.

Types of atmospheric emissions (as described in the operational licence) and relevant measurement techniques are presented below.

Dust
Dust, emitted from cement production processes, is not a toxic substance but is considered a nuisance. The main sources of dust from cement production are the raw materials mill, the kiln, clinker coolers and cement mills. Dust emissions from Podilsky Cement are monitored.

Dust concentration in the exhaust gases is determined on the basis of changes in filter weight measured in a flow of a dust-laden gas for certain period of time. Dust is sampled by internal filtration method in accordance with the national “Methodology of dust concentration measurement in dust-laden process gases”. Accuracy of the measurement is +/-25%. Testing (calibration) of measurement equipment used to measure dust emissions is carried out once a year by an independent state body (State Organization for Standardization, Metrology and Certification).

After the installation of new kiln, new dust filters will be installed. These will impact emissions from the raw materials mill, the kiln and clinker cooler. With the implementation of the JI project, airborne emissions of kiln dust will fall from the current levels (2005) of 150 g/s[22] to approximately 11 g/s, a reduction of more than 10 times.

Nitrogen and sulphur oxides
NOx is formed due to the inevitable oxidation reaction of the atmospheric nitrogen at high temperatures in the cement kiln. In the case of the dry kiln, the level of NOx emissions will be approximately 500 mg/Nm^3. This is within the requirements of the Ukrainian legislation and within the range the Best Available Technology[23] levels of IPPC.

SOx emissions in cement production originate mainly from raw material. The sulphur content in the raw materials used at Podilsky Cement is insignificant and SOx emissions are not observed and should not increase after the implementation of the project. However, the gas analyzing equipment of Podilsky Cement will allow to trace the gaseous emissions of sulphur oxide in case they will appear.

Concentrations of gaseous emissions (including nitrogen and sulphur oxides) in the exhaust gases are measured with the portable gas analyzer 'Testo-350' with sampling unit 'Testo-339'. This equipment allows to detect and measure the emissions of CO, NO, NO2 and SO2 with the accuracy level of +/- 5%.

---

[22] Atmospheric emissions in Ukraine are measured in grams per second.

[23] IPPC Reference Document on Best Available Techniques in the Cement and Lime Manufacturing Industries, December 2001

This device is calibrated once a year by an independent state body (State Organization for Standardization, Metrology and Certification).

In addition to the mobile gas analyzer, kiln #1 is equipped with a stationary gas analyzer SICK-MAIHAK Series S-710 that allows to measure emissions of CO, CO2 and NOx with the accuracy level of +/- 0.4%. The stationary gas analyzer is calibrated once a year by the State Organization for Standardization, Metrology and Certification.

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to supporting documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The environmental impacts of the project are positive as the project reduces the impact of the existing facility. An Environmental Impact Assessment is not deemed necessary at this stage of project development. The impact on the environment of the project will be assessed by the Ukrainian authorities in the following way.

The environmental impacts will be assessed before obtaining a construction permit. The general principles of evaluating the environmental impact (OVNS, which is the Ukrainian abbreviation) procedure in Ukraine are described by the national laws “On the environmental protection” and “On the environmental expertise”. According to the national legislation, every project or new activity that can be potentially harmful for the environment, must evaluate the environmental impact[24] [25].

These environmental impacts are analysed during the development of the detailed project design in order to obtain a construction permit. The OVNS document must provide a list of viable project alternatives, a description of the current state of local environment, description of the main pollutants, risk evaluation and an action plan for pollution minimisation. The final OVNS document has to be presented as a separate volume of the project documentation for the evaluation by a state expert company.

The national procedure for receiving the construction permit is described below.

1. Approval by the local authorities
On the initial stage of the project preparation Podilsky Cement will conduct consultations with the local authorities, namely the council of village of Gumentsi and the administration of the Kamyanets Podilsky region (rayon). Local authorities will be provided with the general information (the so-called notification on the planned activity) about the envisaged project.

2. Setting requirements for the project
In the case of positive conclusion of the consultations, local authorities will issue approval for developing: a) general project design; b) architectural and planning document; c) terms of reference for the project. These three documents are to contain specific environmental, sanitary, architectural and other requirements for the project.

3. Project design phase
Upon the formulation of the requirements from the local authorities and developing the terms of reference, Podilsky Cement will contract a design institute to prepare the project design documentation package. This package has to include:

[24] The Law of Ukraine “On the environmental expertise”, Articles 8, 15, 36

[25] The Law of Ukraine “On the environmental protection”, Article 51

- general project description;
- assessment of environmental impact (OVNS);
- time schedule for the construction works;
- project budget;
- blueprints of the architectural design, general planning and transport.
- Project evaluation

After the preparation of the full project design documentation, as elaborated above, Podilsky Cement will contract an authorized state company to conduct independent evaluation of the project. The evaluation procedure includes receiving of approvals from the following state authorities:

- sanitary authority;
- state authority on environmental protection;
- fire prevention authority;
- energy saving authority;
- labour safety authority.

One of the mandatory part of the state evaluation procedure is the stakeholder consultation process. All interested parties can submit their comments to the project to the company performing the evaluation process. National regulations do not formulate how the stakeholder consultations have to be held. However, Podilsky Cement is committed to actively publish the information about potential impacts of the project (including the environmental impact) and will take into account the comments from all stakeholders.

4. Construction design
Either after receiving positive conclusion of the state evaluation or in parallel with the evaluation process, Podilsky Cement can start the design of construction documentation. The construction documents shall include construction blueprints, specifications of the equipment and construction materials, construction budget, etc.

5. Receiving the construction permit
The package of construction design documents, project design documentation and positive conclusions of the state evaluation have to be submitted to the local authority on the construction and architecture, that finally issues the construction permit.

The preliminary schedule for the preparation of the projcet to Ukrainian permitting requirements is as follows:

1. Preliminary Discussion with Local Authorities	October 2006
2. Preliminary Engineering	November 2006
3. Permit Application Procedure	January 2007
4. Permit Application Evaluation	March 2007
5. Detailed construction design	March 2007
6. Grant of Permit	May 2007
7. Construction Start	May 2007

SECTION G. Stakeholders' comments

G.1. Information on stakeholders' comments on the project, as appropriate:

JI projects are not required to go through a (local) stakeholders' consultation. However, the project was presented to the regional authorities. The response can be found in Annex 4. In the course of obtaining the construction permit, Podilsky Cement will actively publish information about the project to stakeholders as described in section F.2.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT

Organization:	Podilsky Cement JSC
Street/P.O.Box:	Khmelnytske shose
Building:	1A
City:	Kamyanets Podilsky
State/Region:	Kmelnitsky oblast
Postfix/ZIP:	
Country:	Ukraine
Telephone:	+380 (3849) 32356
FAX:	
E-Mail:	sgg@podcem.com.ua
URL:	http://www.podcem.com.ua
Represented by:	
Title:	Director
Salutation:	
Last Name:	Darchuk
Middle Name:	Ivanovych
First Name:	Semen
Department:	
Mobile tel:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	CRH Europe Materials
Street/P.O.Box:	Cabinteely
Building:	Shrewsbury House
City:	Dublin
State/Region:	
Postfix/ZIP:	18
Country:	Ireland
Telephone:	+353 (1) 204 82 00
FAX:	+353 (1) 284 75 40
E-Mail:	egeraghty@crh.ie
URL:	http://www.crh.com
Represented by:	Eamon Geraghty
Title:	Technical director
Salutation:	
Last Name:	Geraghty
Middle Name:	
First Name:	Eamon
Department:	
Mobile tel:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Global Carbon B. V.
Street/P.O.Box:	Benoordenhoutseweg
Building:	23
City:	The Hague
State/Region:	
Postfix/ZIP:	2596 BA
Country:	The Netherlands
Telephone:	+31 (70) 3142456
FAX:	+31 (70) 3142457
E-Mail:	deklerk@global-carbon.com
URL:	http://www.global-carbon.com
Represented by:	Lennard de Klerk
Title:	Director
Salutation:	
Last Name:	de Klerk
Middle Name:	
First Name:	Lennard
Department:	
Mobile tel:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

BASELINE INFORMATION

Capacity of wet and dry kilns

Current wet kilns
In the 1970s Podilsky installed six wet process kilns of length 185 metres and diameter 5 metres. These had a daily production capability of 1632 tonne. In the intervening years, two of the original units were stopped. Subsequently, one of them was decommissioned. The kiln #4 that is mothballed can be rehabilitated to be available for operation should the market growth be bigger than expected.

The clinker production capacity has been calculated as 2.6 million tonne per annum based on 325 rundays per annum with a 2% allowance for short stops, (1632*325*0.98*5). Of the produced cement, 13% consists of mineral additives and 87% of clinker, therefore the overall cement production capacity of the plant is 3.0 million tonne cement.

Proposed dry kiln
The new kiln (one) will be a dry process calciner kiln system. The daily capacity will be approximately 7000 tonne of clinker per day equivalent to 2.3 million tonne clinker (7000*330*0.98). Of the produced cement, 13% consists of mineral additives and 87% of clinker, therefore the overall cement production capacity of the plant is 2.6 million tonne cement per annum.

Determination of baseline factors

Baseline kiln economy
The baseline kiln economy BKE is determined by taking the average of the most recent three years available measurements by the following formula:

$$KE_{av} = \sum_{y} \frac{FF_y \times NCV_y}{CLNK_y} \times \frac{1}{3} \qquad (16)$$

Where:
KE_{av} Average kiln economy per tonne of clinker (GJ/t clinker)
y Years 2003, 2004 and 2005
$FF_{,y}$ Quantity of fossil fuel burnt for clinker production in year y (1000 Nm^3)
NCV_y Net calorific value fossil fuel in year y (GJ/1000 Nm^3)
$CLNK_y$ Amount of clinker produced in year y (tonne of clinker)

The results of the measurements are:

Year	2003	2004	2005	Average
Kiln economy (GJ/t clinker)	6.728	6.849	6.736	6.771

Table 18: Measured kiln economy and calculated average

As can be seen in the table above, the kiln economy is a stable figure with small variations. Therefore the baseline kiln economy can be established by taking the historic average value of the kiln economy. In order to be conservative BKE has been determined by reducing the average measured kiln economy (KE_{av}) to a BKE of 6.684 GJ/t clinker (= 1600 Kcal/kg clinker). This value also represents a standard factor used in the cement industry.

Baseline electricity consumption raw milling and kiln
The specific electricity consumption of the raw milling and the kiln $BELE_{rwmkln}$ (MWh/t clinker) has been determined by extrapolating historic measured consumption. Due to wear out of the equipments, the specific electric consumption tends to increase. Taking a fixed value instead is more conservative. Only measurement in the year 2005 has been used. In 2004 new screw compressors were installed, allowing for a more efficient operation of the compressors leading to reduced electricity consumption. Therefore the measured electricity consumption in 2005 has been taken to determine the electricity consumption in the baseline scenario. This is conservative. The measured electricity consumption in 2005 was 65.3 kWh/t clinker.

Baseline electricity consumption coal mill
The electricity consumption of the coal mill in the baseline scenario will be calculated as described in section D.1.4. For the purpose of estimating the emission reduction potential in section E, the electricity consumption of the coal mill in the baseline scenario has been set at 5.3 kWh/t clinker, based on equipment specifications.

Specific natural gas consumption heat generator
The specific natural gas consumption of the heat generator $BFF_{heatgen}$ (1000 Nm3/tonne coal) will be determined by taking actual measurements of the two years of operation of the heat generator (2007 and 2008), which is after commissioning of the coal mill, and before commissioning of the dry kiln.

$$BFF_{heatgen} = \sum_{y} \frac{FF_{heatgen,y}}{FF_{kiln,y}} \times \frac{1}{2} \quad (17)$$

Where:

$BFF_{heatgen}$ Specific natural gas consumption of heat generator (1000 Nm3/tonne coal)
$FF_{heatgen,\ y}$ Natural gas consumption of heat generator (1000 Nm3)
$FF_{kiln,\ y}$ Coal consumption of kiln (tonne)
y Years 2007 and 2008

For the purpose of estimating the emission reduction potential in section E, the specific natural gas consumption $BFF_{heat\ generator}$ has been set at 10 Nm3/tonne coal based on equipment specifications.

Baseline electricity factor

The baseline emission factor of the Ukrainian grid $EF_{el,y}$ is taken from the standardised baseline factors of the Dutch Ministry of Economic Affairs. Should a new standardized baseline for Ukraine be adopted, the baseline carbon emission factor will be changed accordingly.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
EF_{el}	996	976	956	936	916	896	876	856	836	816	796	776	756

Table 19: Baseline carbon emission factors for JI projects ***reducing electricity consumption*** *(in gCO2/kWh)*[26].

[26] "Operational Guidelines for Project Design Documents of Joint Implementation Projects", Version 2.3

Annex 3

MONITORING PLAN

See for Section D for the Monitoring Plan

Annex 4

LETTER FROM STAKEHOLDER

- - - - -

(English translation)

To: the head of the Board
JSC Podilsky Cement
Semen Ivanovych Darchuk

Dear Semen Ivanovych,

Oblast administration has read the materials regarding the proposed project of applying the dry cement production technology at JSC "Podilsky Cement". "Podilsky Cement" is one of the biggest taxpayers and employers of Khmelnitsky region. The proposed introduction of modern dry technology is very important for the economic, social and environmental reasons.

Financing of the plant's modernisation will be the biggest investment into the cement sector since independence and the biggest foreign investment to the region. Significant reduction of fuel consumption at the plant will allow to reduce the overall fuel dependence of Ukraine. The large-scale modernisation of the plant proposed in the project will secure the existing working places in the long prospective. Reduction of the emissions of dust and harmful gases, that will be the result of introducing the new technology, will improve working conditions at the plant and will have positive effect on the local environment.

The joint implementation mechanism under Kyoto protocol is an opportunity for Podilsky Cement to receive significant additional financing for the modernisation of the plant. The state administration of Khmelnitsky region supports the proposed project of introducing dry cement production technology at Podilsky Cement and the use of JI mechanism for the project implementation.

The head of Khmelnitsky oblast state administration

I. Hladuniak

УКРАЇНА

ХМЕЛЬНИЦЬКА ОБЛАСНА ДЕРЖАВНА АДМІНІСТРАЦІЯ

29005 м.Хмельницький, майдан Незалежності, Будинок рад, тел.76-50-24, факс 76-51-72

26.06.2006 № 99/02-18-2127/2006

на № ______________ від ______________

Голові правління
ВАТ "Подільський цемент"
п. Дарчуку С.І.

Шановний Семене Івановичу!

Облдержадміністрація ознайомилася з матеріалами щодо пропонованого проекту по переходу ВАТ "Подільський цемент" на суху технологію виробництва цементу.

"Подільський цемент" є одним з найбільших платників податків та роботодавців Хмельницької області. Пропонований перехід на більш сучасну суху технологію виробництва цементу є важливим з економічної, соціальної та екологічної точок зору.

Фінансування модернізації виробництва на Вашому підприємстві стане найбільшою інвестицією у цементну галузь з часу здобуття незалежності та найбільшою іноземною інвестицією в області. Значне зниження споживання палива на підприємстві дасть можливість знизити паливну залежність держави в цілому. Масштабна модернізація підприємства у рамках проекту гарантуватиме наявність робочих місць на підприємстві у довготерміновій перспективі. Зниження викидів пилу та шкідливих газів, яке відбудеться внаслідок впровадження нової технології, покращить робочі умови на підприємстві та матиме позитивний ефект для довкілля на локальному рівні.

Використання механізму спільного впровадження згідно з Кіотським протоколом дасть можливість ВАТ "Подільський цемент" залучити значні додаткові кошти на модернізацію виробництва. Хмельницька облдержадміністрація підтримує пропонований проект переходу на суху технологію виробництва на ВАТ «Подільський цемент», а також участь підприємства у механізмі спільного впровадження, з метою виконання цього проекту.

З повагою
голова адміністрації І.Гладуняк

Annex 6

LIST OF DOCUMENTS GIVEN TO VALIDATOR

- Annex 7: Time schedule for project (Microsoft project format)
- Annex 8: Preliminary plant layout
- Spreadsheet calculating CO_2 reductions
- Certificates of natural gas (NCV)
- Preliminary budget for project
- Confirmation by CRH of no approval for kiln project
- Training programme for project Podilsky Cement 2006
- Environmental information including financial, emission data and license limits Podilsky Cement
- Historical production information
- Historical social information including numbers of employees, etc
- Copies of operating licenses
- Copies of cement certificates