

# Modernisation of Shymkentcement Plant



## Non-Technical Summary

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## 1 Introduction

Shymkentcement (the 'Company'), founded in 1958 and part of Italcementi Group since 1998, is undertaking a modernisation program aimed at meeting future cement demand and achieving compliance with Group and other relevant European or International environmental standards.

Wet process kiln technology is no longer considered as Best Available Technology (BAT) for cement manufacturing, due to its inherent energy intensity and due to the high cement kiln dust generation requiring large abatement systems. Therefore, the modernisation process will be focused on implementing a new dry process line, designed in order to increase the efficiency in cement production and mitigate the environmental impacts associated with cement production.

The European Bank for Reconstruction and Development (EBRD) is considering providing a loan to Shymkentcement as well as taking equity in the company. In line with its Environmental and Social Policy (2008), the EBRD has categorised the Project as B and has undertaken independent due diligence on the Project. An Environmental and Social Action Plan (ESAP) has been agreed with the Company to ensure that the Project meets the EBRD's environmental and social requirements.

This Non-Technical Summary presents the key elements of the Project in order to allow all stakeholders to understand the planned investments and their impacts both on the Company's operations and the surrounding area.

## 2 Shymkentcement Plant

Shymkentcement Plant is located in the City of Shymkent, in the southern part of Kazakhstan.



Figure 1 – Shymkentcement Plant location

The plant currently operates four wet process kilns and associated material preparation plants, including quarry and wet grinding mills, and grinds the resulting Portland cement clinker in seven cement mills before dispatching cement from the packing and dispatching facility.

The plant produces six types of cement – PC500DO and PC400DO (equivalent to 42.5 and 32.5 N Portland cement respectively), Oil Well Cement, PC400D20 (an early strength cement), SPC400D80 (a slag Portland cement) and SP 400D0 (a sulphate resistant cement).

The raw materials mix is made up of 4 components – limestone, clay and iron ore (which are all quarried by Shymkentcement) and silica sand (external third party supply). The limestone is quarried 40 km from the plant and is transported to the plant by rail. The clay is quarried approximately 10 km from the plant and is currently pumped via a pipeline to the plant as slurry, the iron ore is quarried approximately 90 km from the Plant.

The Plant was commissioned in 1958 with two wet lines. The third line started to operate the next year, the fourth line in 1960, and the fifth and sixth lines in 1961. In 1988, the existing loam,

limestone and pigment quarries opened. The cement production reached its maximum of 1 million tonnes per year.

In 1999 Ciments Français PLC acquired control set of Shymkentcement shares. Ciments Français PLC was bought by Italcementi Group two years later.

Reacting to the fall of demand for cement, the first two lines were decommissioned in 2006 and 2007. This created an area for the new proposed dry line.

## 2.1 Environmental performance of the existing plant

Shymkentcement operates an Environmental Management System that is certified to the international standard: ISO 14001.

The Plant has developed an Integrated Environmental Action Program for 2012 to 2016 as part of the comprehensive technical modernisation program.

This long-term program is mainly focused on emissions and dust reduction and in building environmental awareness.

Investments in air quality protection (e.g. improving and maintaining filters) are supposed to be continued within 2014 while other actions are continuous and will be repeated every year.

In total, the Plant will spend approximately 575,000 euros on the planned environmental actions.

The main environmental issues associated with cement production are related to emissions to air. The key emissions are nitrogen oxides (NOx), sulphur dioxide (SO<sub>2</sub>) and particulate matter (dust).

Electrostatic Precipitators (EP) for kiln exhaust gas are in use on all 4 kilns, with two recent additional EP sections enhancing the dust collection of the four previously installed EP. Continuous emissions monitoring systems (CEMS) are installed, including NOx, SO<sub>2</sub>, CO, VOC, Oxygen and flowrate are also measured on this equipment.

Environmental targets are set aiming for the continuous reduction of dust, SOx and NOx emissions from the two main stacks. Emission targets are presented below together with authority permitted limits.

*Table 1 - Dust, SOx and NOx Emission Targets*

<b>g/sec</b>	<b>Permit</b>	<b>2013</b>	<b>2014</b>
<b>NOx</b>	37.59	25.54	25.52
<b>SOx</b>	22.9	6.54	6.52
<b>Dust</b>	9.18	4.13	4.11

The Company contracts a certified laboratory to monitor air emissions at 35 source points and at 4 control points at the boundaries of the Sanitary Protection Zone (SPZ) on a quarterly basis, and water release from the quarry on a monthly basis. Monitoring results confirm compliance with the permitted limits.

Other environmental aspects, such as water use and discharge, waste production and disposal, and management of chemicals, are managed in compliance with the applicable regulations.

### 3 The new dry line

Wet process kiln technology is no longer considered as BAT for cement manufacturing mainly due to its inherent energy intensity and to the difficulties in achieving high emission abatement, with filters having to work in aggressive environments.

Therefore, progress towards BAT starts with the conversion from wet cement manufacturing to dry cement manufacturing, allowing for top operational and environmental performance.

Shymkentcement Plant has initiated a project to construct a new, 3200 tonnes per day, modern precalciner dry process kiln line, to be erected adjacent to the existing wet process lines, which will then be dismantled.

The design, engineering, supply and installation of the new line have been awarded to the Chinese cement plant supplier CTIEC, part of China National Building Material Group. Construction started in 2014 and the new dry line will be ready by 2016.

Some infrastructure from the old wet lines will be used for the new plant, either in their existing form or in a modified/up-rated version.

#### 3.1 Overview of cement production

Cement is a basic material for building and civil engineering construction.

Cement is a finely ground, non-metallic, inorganic powder, and when mixed with water forms a paste that sets and hardens. This hydraulic hardening is primarily due to the formation of calcium silicate hydrates as a result of the reaction between mixing water and the constituents of the cement.

Cement is produced in two steps: first, clinker is produced from raw materials. In the second step cement is produced from clinker.

The basic chemistry of the cement manufacturing process begins with the decomposition of calcium carbonate ( $\text{CaCO}_3$ ) at about  $900^\circ\text{C}$  to calcium oxide ( $\text{CaO}$ , lime) and liberated gaseous carbon dioxide ( $\text{CO}_2$ ); this process is known as **calcination**. Naturally occurring calcareous deposits, such as limestone, provide the source for calcium carbonate.

This is followed by the **clinkering** process in which the calcium oxide reacts at a high temperature (typically  $1400\text{--}1500^\circ\text{C}$ ) with silica, alumina, and ferrous oxide to form the silicates, aluminates, and ferrites of calcium which comprise the clinker. Silica, iron oxide and alumina are found in various ores and minerals, such as sand, shale, clay and iron ore.

The clinker is then ground or milled together with gypsum and other additives to produce cement. In the dry process, the raw materials are ground and dried to raw meal in the form of a powder.

Various fuels (conventional and waste) can be used to provide the heat and the energy required for the process. Different types of conventional fuels are mainly used in cement kiln firing; such as solid fuels (e.g. coal), liquid fuels (e.g. fuel oil) and gaseous fuels (e.g. natural gas). The current wet lines use a mix of coal and gas. The new dry line will use coal.

A typical process flow diagram of a cement plant is shown in Figure 2.

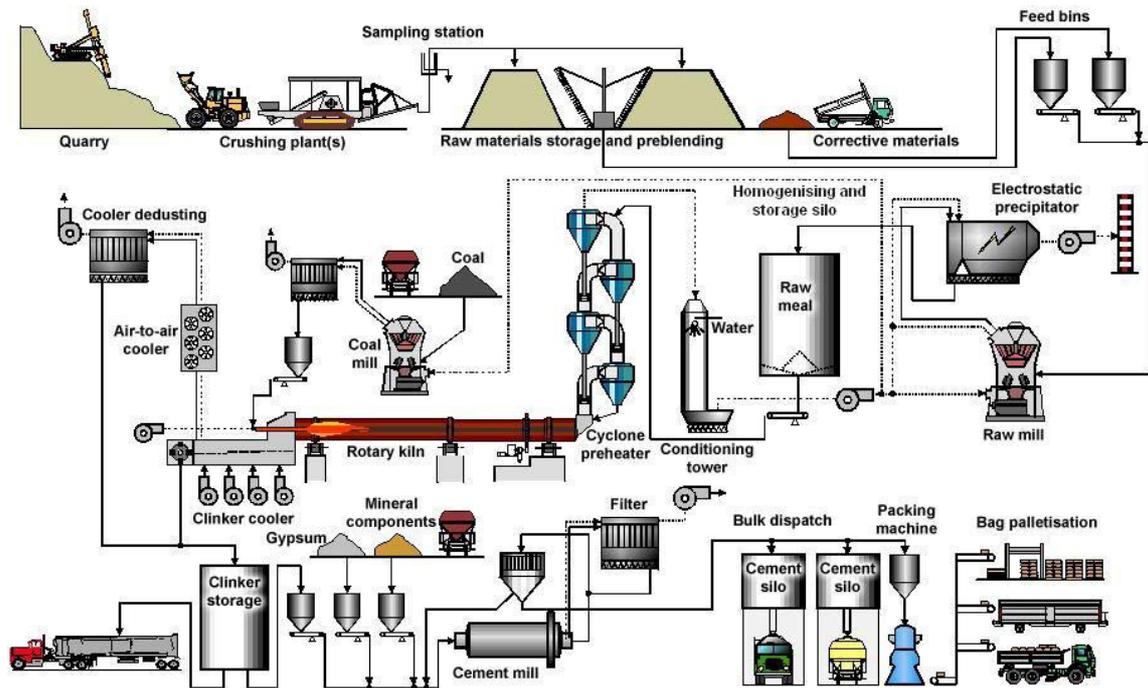


Figure 2 - General overview of a cement manufacturing process (Source: CEMBUREAU, 2006)

### 3.2 Raw materials preparation

The existing limestone crusher will be used for the new line. The crusher's fabric filter will be upgraded as part of the project.

The crushed material will be transported to a new covered circular storage and pre-blending system. Iron ore will also be crushed in the limestone crushing system and then fed directly to the intermediate storage hopper of the raw mill.

A new crusher and storage/pre-blending system will be erected for both clay and sand. Clay and sand storage will be covered.

Clay will no longer be transported by pipeline in slurry form. This is due to a switch to the dry process. Clay will be transported to the plant by truck.

### 3.3 Raw Milling

Raw meal production will be achieved using a new vertical roller mill with a final product capacity of 270 tonnes per hour of raw meal.

The mill will be equipped with an auxiliary burner system which will be used when kiln gases are not available and burn gas.

The choice of the vertical roller mill is considered as BAT for raw milling.

A fabric filter will dedust flue gas from the raw mill, also collecting the process gases from the kiln system. According to Group internal standard and BAT, the filter is designed for a clean gas content of  $<10\text{mg}/\text{Nm}^3$  of particulates

### 3.4 Raw meal Homogenization

A low energy, conical base meal homogenization silo is planned. This is currently considered to be BAT. Raw Mill product conveying to, and blended kiln feed conveying from the homogenization silos is by state of the art, low energy belt bucket elevators.

### 3.5 Pyro-processing Plant

The pyro-processing supply comprises kiln, preheater, precalciner, cooler and all associated firing and environmental systems.

#### 3.5.1 Kiln Plant

The rotary kiln is 4.2 metres in diameter and 60 meters in length. The warranted output performance is for 3200 tonnes of clinker per day.

#### 3.5.2 Preheater

The preheater is a 5-stage single string high efficiency preheater. Considering locally available raw materials, the selection of a 5-stage preheater complies with BAT.

The pyro-processing system will be fitted with a gas analyser at the kiln inlet to measure O<sub>2</sub>, CO, SO<sub>2</sub>, CO<sub>2</sub> and NO<sub>x</sub> and another analyser will be fitted at the calciner exit to measure O<sub>2</sub>, CO and NO<sub>x</sub>. These analysers will allow the combustion process to be optimised to ensure full combustion of the fuel as well as NO<sub>x</sub> control from the calciner.

#### 3.5.3 Precalciner

The specified precalciner design is the RSP (Reinforced Suspension Preheater) type.

The supplier has warranted the pyro-processing line at 700 mg/Nm<sup>3</sup> NO<sub>x</sub> on a dry basis at 10% oxygen.

Shymkentcement will experiment with the calciner operation to identify the minimum NO<sub>x</sub> emission that can be achieved prior to identifying other methods for NO<sub>x</sub> emission reduction such as Selective Non-Catalytic Reduction (SNCR) to bring NO<sub>x</sub> emissions below the EU BAT limit of 450mg/Nm<sup>3</sup>, also matching Group internal standard.

#### 3.5.4 Cooler

As per BAT, the new cooler will feature a fixed aeration section to spread the clinker and a moving section with enclosed air beam air injection to ensure cooling air passes the bed.

Air to air heat exchanger and fabric filter, as recommended under BAT will be installed on the cooler's exhaust. The filter is designed for a clean gas content of <10mg/Nm<sup>3</sup> of particulates.

### 3.6 Clinker Storage

The existing clinker storage of the plant will be used. Gypsum will also be stored in the clinker building.

### 3.7 Cement Milling and Storage

The existing cement mills will be used for cement milling, with two mills being converted from open circuit to closed mills. This involves the addition of a high efficiency cage separator and new bag filter which will be shared by two mills. The new bag filter will have a guaranteed emission of <10mg/Nm<sup>3</sup>. The closed circuiting of the mills will reduce the specific power consumption of the mills.

### 3.8 Packing and Loading

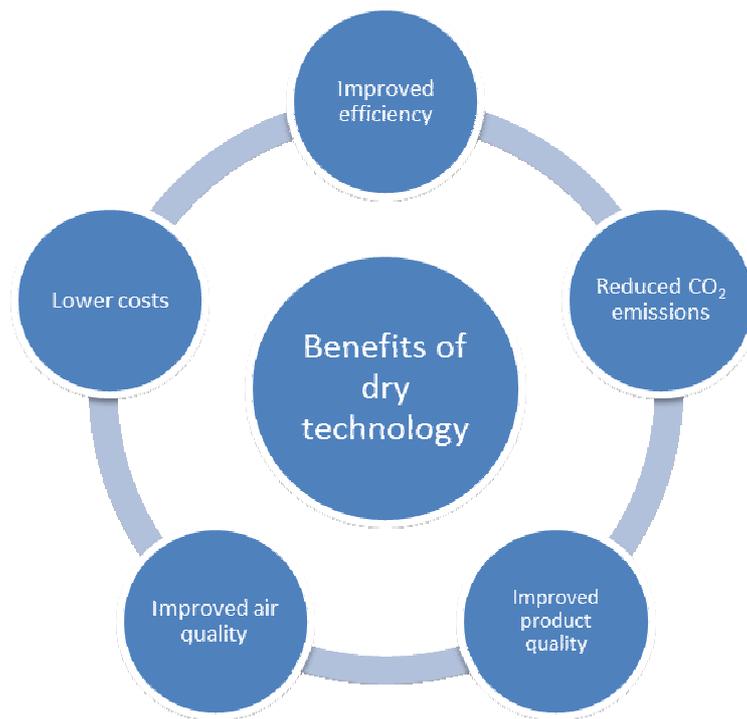
The existing packing plant and loading facilities will be used.

## 4 Benefits of Modernisation Programme

Besides guaranteeing significant quality improvements and energy savings, the modernisation project and the replacement of old inefficient wet lines with a state-of-the-art new dry line will substantially decrease environmental impacts from the Plant operations.

Wet lines are no longer considered as BAT due to their lower efficiency and higher emissions.

The modernisation program will bring benefits to the Shymkentcement Plant from an environmental, economic and social point of view.



The main advantages of the dry cement manufacture process are among others:

- Lower fuel consumption compared to wet process;
- Higher production efficiency;
- Lower maintenance and repair costs;
- Relatively smaller space (footprint) requirement, resulting in lower construction costs as compared to a wet process line of similar capacity;
- Improvement of air quality due to the reduction of emissions of air pollutants such as NO<sub>x</sub> and dust;
- Reduced specific CO<sub>2</sub> emissions (tons of CO<sub>2</sub> released/tons of clinker produced);
- More consistent product quality;
- Possibility to use less energy-rich fuel allowing for opportunities to use fossil fuel substitutes.

## 4.1 Environmental impacts

Impacts from the construction and operation of the new dry line have been assessed as part of the Environmental Impact Assessment, which recently obtained approval from the Ministry of Nature and Water Resources, and through environmental and social due diligence by the EBRD.

The new dry line will bring significant improvements in terms of efficiency (reduced fuel and power consumption) and pollution prevention (reduced air emissions).

### 4.1.1 Resource intensity

Key Performance Indicators (KPIs) for the future dry kiln, compared to the existing wet lines, are shown in the table below.

Table 2 – KPIs for wet (current) and dry (future) lines

	SCC Current (2013)	SCC Future (2017)
Thermal Energy Intensity (MJ/kg clinker)	7.33 <sup>(1)</sup>	3.27 <sup>(2)</sup>
Carbon Intensity (kg CO <sub>2</sub> /kg clinker)	1.277 <sup>(3)</sup>	0.891 <sup>(4)</sup>
Electrical Energy Intensity (kWh/tn clinker)	89,9	65 <sup>(5)</sup>
Water Intensity (lt/tn cement)	1385 <sup>(6)</sup>	215 <sup>(6)</sup>

(1) Based on an annual average fuel consumption of 1750 kcal/kg

(2) Based on an annual average fuel consumption of 780 kcal/kg

(3) Estimated based on fuel consumption of 1750 kcal/kg

(4) Estimated based on fuel consumption of 780kcal/kg

(5) CTIEC guarantee of 59.5 kWh/tonne plus estimated 5.5 kWh/tonne for crusher and coal grinding

(6) Based on a cement/clinker ratio of 1.3

A significant decrease is expected for all parameters, since the new technology will be much more efficient.

Coal will be the primary fuel for the new kiln line, although the main burner will be capable of firing both coal and gas. Once the new line is commissioned, a roadmap for the use alternative fuels (e.g. biomass or solid domestic waste) will be developed.

### 4.1.2 Air emissions

The new kiln will be equipped with a new fabric filter for the de-dusting of raw mill/kiln waste gas. The filter is designed and warranted for a clean gas content of <10mg/Nm<sup>3</sup> of particulates. The selection of the fabric filter instead of an electrostatic precipitator is considered as BAT and will ensure that dust emissions are within EU BAT limits. Particulates from the bag filter will be measured using one of the existing Continuous Emission Monitoring Systems (CEMS).

The guaranteed NO<sub>x</sub> emission proposed by the equipment supplier is 700 mg/Nm<sup>3</sup> on a dry basis at 10% O<sub>2</sub>. This level of NO<sub>x</sub> is above the BAT upper limit figure of 450 mg/Nm<sup>3</sup> at the same gas conditions. Some optimization of the burning conditions in the calciner vessel will be possible by varying the amount of tertiary air that is used in the combustion of the fuel, but eventually Selective Non-Catalytic Reduction (SNCR) is likely to be required to reach the BAT level of NO<sub>x</sub> emission.

Shymkentcement has received an authorization level equivalent to approximately 1000 gm/Nm<sup>3</sup> on a dry basis at 10% oxygen for the commissioning and stabilization of the plant. This will then allow the best NO<sub>x</sub> emissions for the operating conditions to be established and therefore the requirements for SNCR to be identified. The Company has committed to meeting the EU BAT limit within two years of plant commissioning.

## 4.2 Social impacts

Persons, groups or organizations who may be directly or indirectly affected by Shymkentcement's current or planned operations include: local authorities, residents of neighbouring areas, investors and lenders, other neighbouring facilities, Plant's personnel, suppliers of goods and services, and customers.

Health and safety aspects of the Plant's operation will be further improved after the modernization. Negative impacts are expected to some suppliers of services that are related entirely to the wet process, since the wet lines will be decommissioned.

No involuntary resettlement and economic displacement or impact on cultural heritage is expected.

A road traffic management plan will be developed to manage the increased road traffic due to the future transport of clay via trucks.

The construction phase will involve a large number of contractors: the Company will continuously monitor contractors' environmental, social and occupational health and safety performance and ensure that constructions workers' camps in living conditions meet international standard requirements.

Particular attention will be made to mitigate impacts on the surrounding areas and nuisance to neighbours during the construction phase.

## 4.3 Planned management and monitoring systems

Shymkentcement Plant has an integrated environmental, sustainability, and safety management system.

The Environmental Management System is certified to the international standard ISO 14001. Alignment of the current Health and Safety management system, with international standard OHSAS 18001 is planned by mid-2016.

Also, the Plant will develop and implement an Energy Management System, to be certified according to ISO 50001 by mid-2016 at latest.

A monitoring program will be implemented to constantly control environmental impacts from the Plant's activities.

The new line will be endowed with a Continuous Emission Monitoring System (CEMS) for NO<sub>x</sub> and dust, to constantly monitor compliance with regulatory and BAT standards.

The Company will also continue to monitor air quality (NO<sub>x</sub>, SO<sub>2</sub>, CO and particulate matter) along the boundaries of the Sanitary Protection Zone (SPZ), to ensure public health is protected.

## 4.4 Planned stakeholder engagement

Shymkentcement Plant has developed a Stakeholder Engagement Plan in order to enhance public information disclosure and the stakeholder engagement process, especially in relation to the ongoing modernisation project.

Notifications have been published in the Regional press and public hearings have been carried out as part of the local Kazakh Environmental Impact Assessment process.

All documents, including the environmental impact assessment (OVOS), regarding the modernisation will be made available for public consultation on the Company's website and at the Plant offices in Shymkent.

Additional information regarding Italcementi Group operations and the modernisation program at ShymkentcementPlant is available at:

- Shymkentcement's website: <http://www.shymkentcement.kz/>
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